THE FOUNDRY

for June

NRA Is Dead
Long Live Industry

RESTRICTIVE laws preventing legitimate industry from conducting lawful and necessary business cannot endure. Morals have never yet been legislated into a people.

Without discussion on either merits or shortcomings of NIRA, those who have observed, realize that the decision of the Supreme Court only anticipated its complete disintegration. Non-observance, unwilling compliance, by a certain number, administrative confusion, weak and timid enforcement, all moved to terminate this experiment. NRA eliminated none of the conflicts between the self-interest of groups, industries, classes or individuals. Business finds its dependence on governmental agencies misplaced.

American business has succeeded and grown because it is essentially honest. A national effort to straitjacket all business in order to curb unfair and dishonest practices of the few never was necessary. Sweatshops and all abuses resulting from importation of oriental standards can be controlled and punished by any state.

Employment By Industry

The immediate and tremendous necessity now for American business is to determine how it can stimulate industry. It must find out how it can relieve unemployment. Government has proved itself of no help in this desperate need.

Self-interest is the only motive power which governs human action in business or any other relationship. It applies from the front office to the gateman's shanty. Its power never fails. It is often unintelligent, short-sighted and dumb. There can be no truce with self-interest. It must be enlightened. It must look into the future, as far as human eye can see. It can be intelligent.

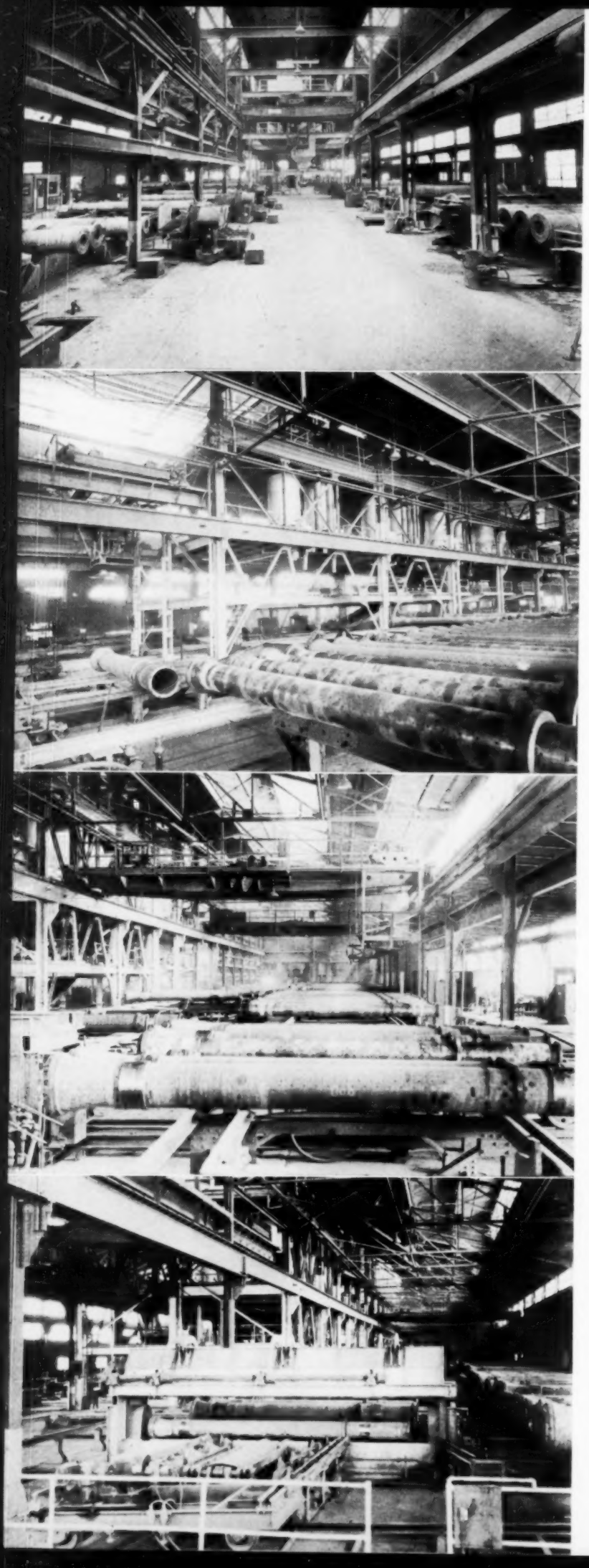
The long-time good of American business spells the long-time good of all America. The long-time good of individual companies depends upon the prosperity of the particular industry or branch of the industry to which each belongs. Remember, if you can, and ask—Where are the buggy makers? Foundries can die the same slow death. Their product can be supplanted by other materials. No one unit can save itself while its competitors perish.

No one branch can prosper if the others fail. Encroachment of competing materials upon the gray iron field, soon impairs the market for malleable and steel castings. Improvements in metals, treatment, materials and sales practices pioneered in one field soon become the valued aid to others in the foundry industry.

Wanted—Industry Leadership

Higher and again higher standards of fair dealing, co-operation and service must be established. Those industries in which there is a single dominant firm with resources, character and enlightened self-interest will lead. Strong leadership is all that is needed. Trade associations again must function in the community interests. The self-interest of each branch compels new intensified attention to technical, manufacturing and sales problems. The product must be made better. The scope of usefulness must be expanded. The needs are unlimited. The fields for research are immeasurable. Education of users must be immensely expanded.

The crippled eagle is out. There must be no vultures. In gray iron; in brass; in steel; in malleable; where are our leaders? Which men or companies have the intelligence? Who has the character? Where will leadership arise? The times challenge our industry. How shall we meet the challenge? If we are worthy, we must. If not, the vultures will pick our bones along with those of the blue eagle. Prosper or perish!



Workmen Take Pride In a Clean Plant

By FRANK G. STEINEBACH

SEVERAL weeks ago a group of men, customers and prospective customers, was inspecting the large manufacturing establishment of the Florence Pipe Foundry & Machine Co., located on the banks of the Delaware river at Florence, N. J. These men, chiefly municipal engineers and purchasing agents, found their greatest interest in the recently completed sand spun pipe plant, where cast iron pressure pipe in a variety of sizes and lengths is produced centrifugally in sand lined molds.

As the men moved down the wide aisles, fascinated by the rhythmic movements of the workmen as, with clock-like precision, the sand mold was swung into place in the machine, the metal poured and the mold spun rapidly until the metal had solidified in it to just the proper point, many were adding to the pleasure of the occasion with a smoke. When the tobacco went out for lack of proper attention, or the cigar or cigaret reached the stage where the purpose of its existence had been fulfilled, burned matches, and the remains of cigars and cigarets were dropped here and there on the foundry floor; for that is the usual procedure with foundry floors.

An observer, standing off at one side, might have noticed that just as soon as the group moved on, a man from the crew operating one of the machines would step out quickly, pick up the stubs and dead matches that had been dropped and place them in a container especially provided for the purpose. Shortly several of the visitors, glancing back, noticed this

Fig. 1 to 4—General views of the sand spun pipe plant, showing the cleanliness and orderliness of the plant. The equipment for removing pipe from the mold, with hood to arrest the dust, is shown at the bottom

unusual action of the workmen and inquired of the guide the reasons for the seemingly unprecedented attention given to such a small detail as a burned match in the foundry gangway.

Briefly the visitors were told that workmen of the company will not permit refuse of any kind to be found within the shops or on the vast grounds at Florence. Pride in skilled workmanship exceeds only the pride in having a clean, safe place in which to work, and no employe of the company will allow himself the careless laxity of even flipping a burned match or dropping a small piece of paper on the plant property. All of this interest in cleanliness is purely voluntary, with no penalties attached save the displeasure of fellow workmen.

Co-operative Accomplishment Remarkable

While every man who witnessed the incident could not help but pay tribute to the high type of management which could make such wholehearted co-operation possible, the complete story of the results accomplished at Florence had not been told. When it is realized that the plant and property of the Florence Pipe Foundry & Machine Co. is without a doubt one of the cleanest establishments of its kind in the United States, and that the entire good housekeeping program does not depend upon a large force of men employed for that purpose, but is taken care of almost entirely by the regular force of men engaged in the various production jobs throughout the plant, accomplishment of the management is revealed as all the more remarkable.

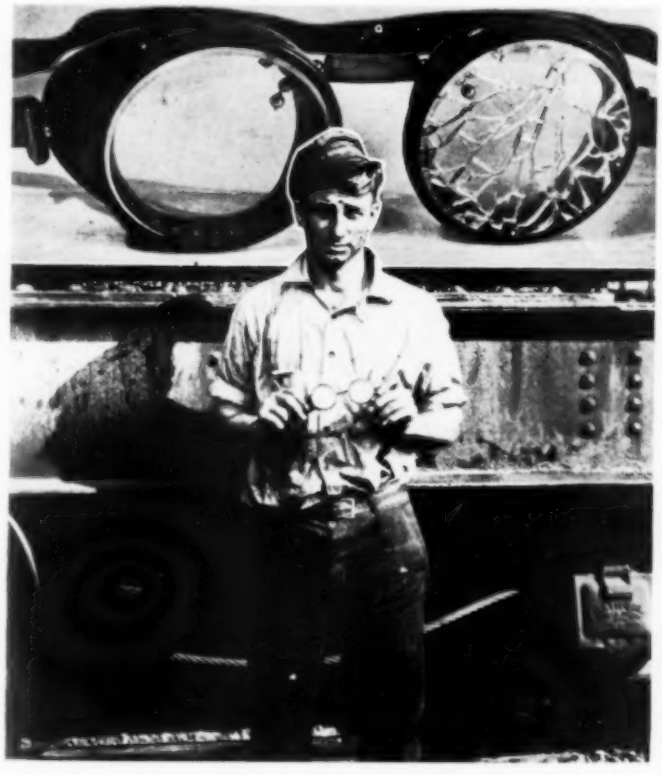


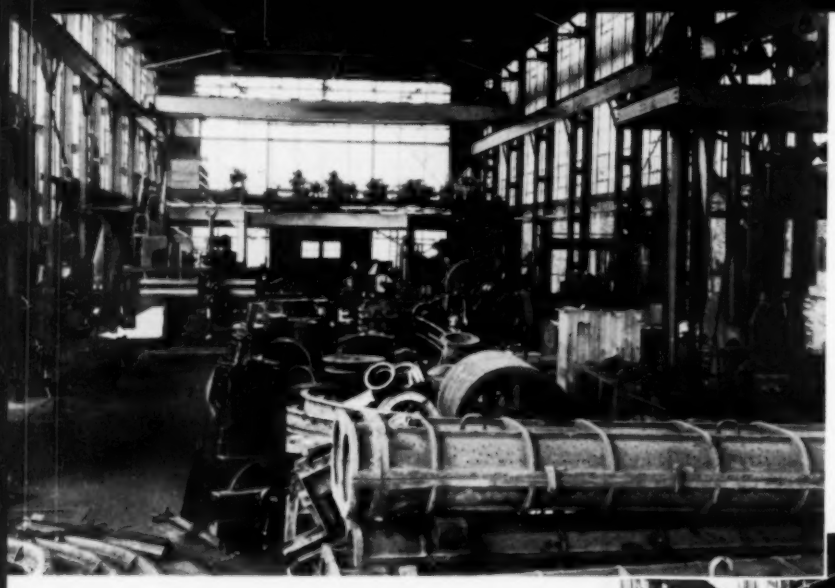
Fig. 5—Type of display used to teach the men the value of goggles. The fact that this man is an employe of the plant adds greatly to the value of the poster

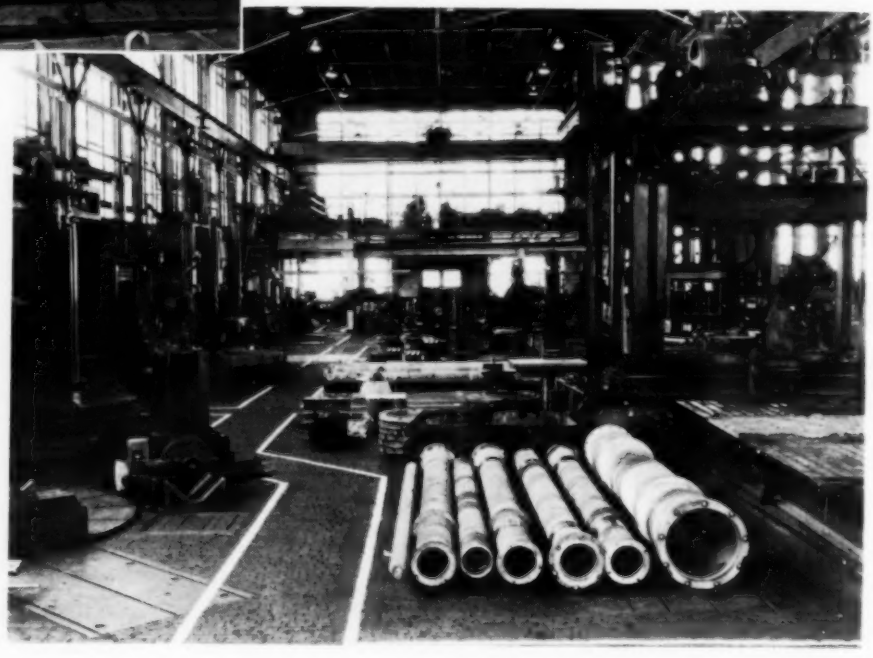
Fig. 6—This picture, used for poster work, shows an accident in the plant in which a safety shoe prevented a serious injury

Like so many basic principles, which clearly differentiate modern industrial relations from those of the past, the safety and good housekeeping program of that company was not evolved overnight, but represents a gradual development and educational effort extending over approximately 10 years. In 1925 the company concluded that the number of lost time accidents throughout the plant was greater than should be expected, and, what is more to the point, greater than should be permitted. The situation was given careful study by the management and the start was made on a program based on the supposition that plant safety depends about 10 per cent on safety equipment and 90 per cent on cleanliness, order and co-operation. Other foundries, when asked for advice, in outlining the work, gave willingly of their funds of information on the subject.

Safety Committees Appointed

With the safety and good housekeeping effort so closely interwoven, a general understanding of the mechanics of the educational program is essential to a clear picture of the remarkable results which have been accomplished. Shortly after the start of the drive for greater safety, a safety director was employed to head the project. Sometime later he was given the additional duties of personnel director. Under his direction five safety committees function throughout the plant. A general safety committee is made up of five key men appointed by the management and rotated among the personnel of the plant from time to time. The remaining four safety groups of one or more plant divisions are made up as follows: Group 1.—Sand spun pipe shop; Group 2.—Machine shop and pattern shop; Group 3.—Maintenance, electrical department, yard, trucks and blacksmithshops; Group 4.—Hydrant and loam foundry, brass foundry, laboratory and office. The groups, divided in this way, each represent approximately the same man-hour ex-





Figs. 7 and 8—Two views of the company machine shop, taken from the same position, showing the result of the good housekeeping program. The view above shows the plant before program was started and the one at the right the shop as it is today

posure. Each of the four specific safety committees have from 10 to 16 members, including the chairman and secretary, selected by the safety director. Members of these committees are rotated every 3 months, with the idea of eventually having every man on the payroll serve on a safety committee.

Each of the four divisional safety groups meets half an hour each week to discuss any subject which, in the opinion of the committee members relates to plant safety. The safety director and the foremen, whose shops are represented in the particular group, sit in on these meetings. At first it was found that considerable time was spent in discussing suggestions having to do with small repairs which normally should be handled automatically by the foremen. Now such items are given directly to the foremen so as to prevent the mixing of maintenance operation with safety work.

Minutes of weekly meetings of the divisional safety committees, containing all suggestions made by the members, are sent to the general safety committee. The latter group either recommends or disapproves the suggestions contained in the minutes, then passes them on to the management. If a suggestion proposed in the minutes is upheld by the management, the work then is started in the various departments. Any part of the recommendation having to do with the conditioning of a building or equipment, is sent directly to the engineering department which has entire charge of plant equipment and maintenance. It is interesting to note in this connection that considerable time is spent in discussing plant good housekeeping practices.

In the development of the safety-good housekeeping program, the management first sold the foremen upon the absolute need of safety work in the plant, then placed the responsibility directly upon them to see that the plan is carried out and that the recommendations of the safety committee are followed. The management has done much through educational work and in the purchase of equipment to sell the employes on the value of safety to their own well-being. For example, an annual safety meeting of the entire company is held once a year, with 98 per cent of the employes attending voluntarily. The meeting is devoted to talks on safety, lantern slides showing results of accidents, and exhibits of shoes and goggles which have prevented accident to the feet or eyes. The governor of New Jersey was the principal speaker at the meeting last year. A view of the crowd at a recent general safety meeting is shown on the front cover of this issue of THE FOUNDRY.

While the company avoids the use of standard signs wherever possible, bulletin boards are provided in each department for posting of minutes of the safety committees and also certain original safety suggestions. If a workman in the plant suffers from an accident, such as dropping a heavy object on his foot, or having molten metal strike the protecting goggle, photographs are made, as shown in Figs. 5 and 6, and are placed on the bulletin board in each department with a caption pointing to the value of the particular safety equipment in saving the foot or eye of a plant employe. That type of safety poster seems to be exceptionally valuable since the workman is known to many of the group, and the circumstances of the accident usually

are familiar to many employes of the company.

All men in the plant must wear safety shoes. This also applies to any of the office force who find it necessary to go into the plant at any time. The shoes are purchased by the company and sold to the employe at cost plus a small handling charge. In case the shoe is damaged in an accident in the plant, the employe may take the damaged shoe to the safety director and he will be given a new pair free. Such damaged shoes are used for exhibition purposes in keeping the workmen sold on the value of that part of the safety program. The idea of giving the new shoes permits the management to learn of minor accidents which otherwise might not be reported.

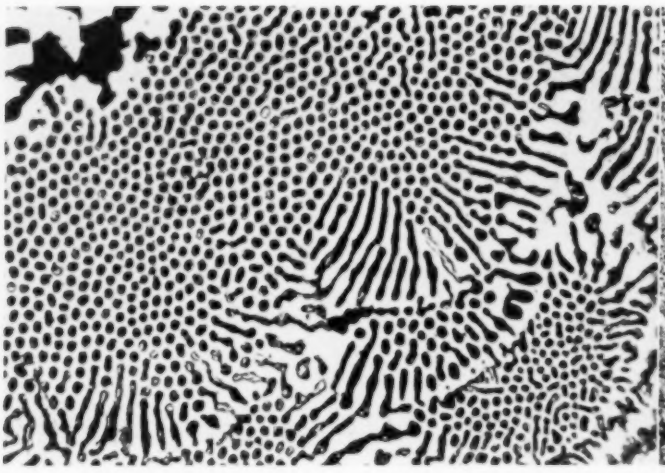
Men handling molten metal, grinding, chipping, and doing any other work where the eyes may be endangered, are required to wear goggles supplied by the company. Foremen are given the responsibility of seeing that goggles are worn but the matter of education has been so complete that the men are glad to wear the goggles for their own protection. The company also supplies respirators, rubber boots, and other safety items for such operations as require the particular type of protection, also waterproof clothing for men exposed to weather.

About a year ago, the company provided the means for a free eye examination for every employe. Specific recommendations were made in each case from this eyesight survey, and while purchase of glasses was not compulsory, practically all of the employes with impaired vision welcomed the opportunity. Glasses are purchased by the company and repaid by the employe at a low weekly rate. The result of the survey provided the company with a complete record of the vision of every man in the plant. It is interesting to note that the survey revealed some men who were working in the plant on hazardous jobs, had exceedingly poor vision.

Work of the entire safety-good housekeeping program is so intervwoven that it is difficult to determine what factors may be classified under the heading of safety and what part of the program may be considered in the category of good housekeeping. For example, certain regulations regarding the storage of material have been prepared from the standpoint of safety, but the operation of these rules lead directly to plant cleanliness. As a specific instance, nothing can be stored within 3 feet of the exterior wall of any building. Along the railway tracks within the plant, over which raw materials are moved to the foundry, and the finished product is transported to the pipe storage yard, at one end of the property, nothing can be stored less than 4½ feet from the nearest rail on straight tracks and 5½ feet from the nearest rail on curved tracks. An aisle 3 feet wide must be kept in the flask storage yard, and an aisle at least 5 feet wide must be maintained between the rows of pipe in the yard. No written instructions covering such rules are available but the regulations are announced at foremen's meetings and that group is expected to see that they are carried out.

Results of such regulations are readily apparent in an inspection of the plant proper. Take for example, the fitting shop flask storage yard shown in Fig. 9 Here it may be noted that only flasks of one type and size are placed on a pile and that the regulation aisle of 3 feet is provided so that flasks may be moved from storage to the (*Please turn to page* 60)

Fig. 9 (Above)—Flask storage for the fittings shop, showing the orderly arrangement of equipment. Fig. 10 (Right)—Flasks for the sand spun plant



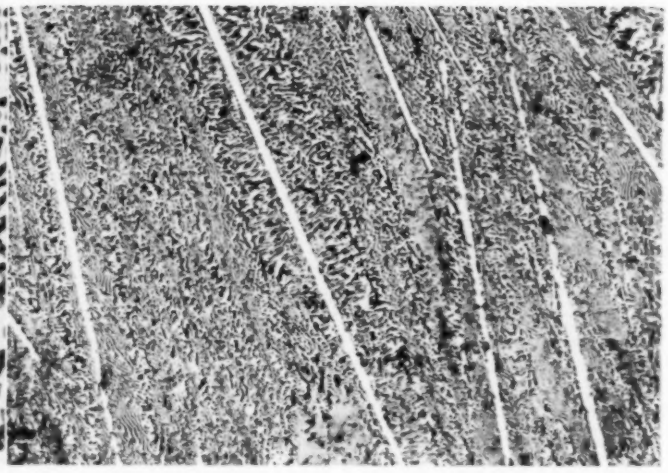


Fig. 43 (Left)—Microstructure of an eutectic iron, x 500. Fig. 44 (Right)—Microstructure of a hypereutectic specimen, x 50. Both microstructures are taken at different points on the same white iron, which contains only minute impurities such as usually present and in addition some boron which shifts the eutectic point sufficiently so that the material becomes hypereutectic. Illustrations courtesy H. A. Schwartz, National Malleable & Steel Castings Co.

GRAY CAST IRON

By JOHN W. BOLTON

Chapter II

EXPRESSED in simplest and broadest terms, gray irons are the alloys of iron, carbon and silicon which contain most of their carbon in the graphitic form. For the moment we ignore the presence of phosphorus, sulphur, manganese and other elements. Iron carbide, called cementite (Fe_3C), probably is dissolved largely as such in molten iron. On cooling and solidifying, and in the absence of silicon, the carbon usually is retained largely as combined carbon or cementite. The *solubility* of the cementite in solidified iron is limited, hence the excess is precipitated as *free* cementite. Silicon, when present in sufficient amounts in high carbon alloys, namely cast irons, together with slow cooling cause the compound cementite to be broken down rather rapidly, partially, or wholly into its final components, iron and carbon, or in other words, iron and graphite. The final or completed reaction below the eutectoid may be represented in simplest fashion by the following equation, although the actual mechanism is somewhat more involved.

$Fe_3C \rightleftarrows 3$ Fe and C plus energy

Cementite $\rightleftarrows$ iron plus graphite plus energy

Graphite, being insoluble, agglomerates and appears as free flakes. The compound cementite behaves as though it were less stable than its components, iron and carbon.

Cementite then is termed a metastable compound, and the structure iron and graphitic carbon represents the final stable state in gray irons and steels at room temperature and up to the eutectoid transformation temperature. Metallurgists have accepted this in theory for many years, yet a final demonstration of the applicability of that theory to low carbon steels low in silicon was given by A. B. Kinzel and R. W. Moore as recently as October, 1934—A.I.M.E. Technical Paper 565, 1934—*Graphite in Low Carbon Steel.* It is interesting to note that Kinzel and Moore found complete graphitization of a steel, carbon, 0.15 per cent, manganese, 0.49 per cent, silicon, 0.02 per cent, sulphur, 0.23 per cent, phosphorus, 0.015 per cent. This steel was in a tube of a cracking still subjected to temperatures somewhat below the eutectoid for about 3 years.

It is maintained by some investigators that graphite often can form directly on solidification of the molten iron, the formation and subsequent decomposition of cementite not being a necessary step in all cases.

The recognition of two possible modes of formation of graphite, namely direct from melt, or from decomposition of cementite, has led many metallographists to use a double equilibrium diagram to depict fully the possibilities subsequent to solidification of molten iron-carbon alloys.

Constitutional changes within the more simple alloy systems are depicted conveniently by constitutional or equilibrium diagrams. These diagrams indicate various changes within alloy systems corresponding to various conditions in composition and temperature, assuming equilibrium is obtained. Methods used in establishing or determining equilibrium diagrams and the

numerous types of equilibrium diagrams, are described at length in most elementary metallurgical text books, to which the reader is referred. It is sufficient for our present purpose to state that various phase and constitutional changes are accompanied by energy changes and often by change in magnetic characteristics, strength, hardness, corrosion resistance, etc. Points at which such changes occur are determined by pyrometric measurements or cooling curves, by magnetic determinations, by length and volume changes or dilatometric methods, by changes in electrical resistance, by quenching the alloy from various temperatures and examining the microstructure, etc.

Equilibrium diagrams for most binary or two component systems of various metals and metalloids have been established at least fairly well. By taking various compositions, starting from 100 per cent pure metal *X*, 0 per cent pure metal *Y*, 90 per cent *X* and 10 per cent *Y* etc. to 100 per cent pure metal *Y* and determining and plotting the various thermal arrests against corresponding compositions, a two dimensional diagram results. Other evidences of structural changes, if existent may be found in various ways as previously suggested, and incorporated in the diagram.

In case of ternary or three component, and more complex systems the problem is not so simple. A true ternary system is three dimensional and the constitutional change regions must be depicted by surfaces rather than lines. Space models of some ternary systems have been constructed. It also is possible to form ternary diagrams by isometric projections. These methods are rather clumsy. No simple methods of graphic representation of quaternary or four component systems and systems of higher magnitude are available.

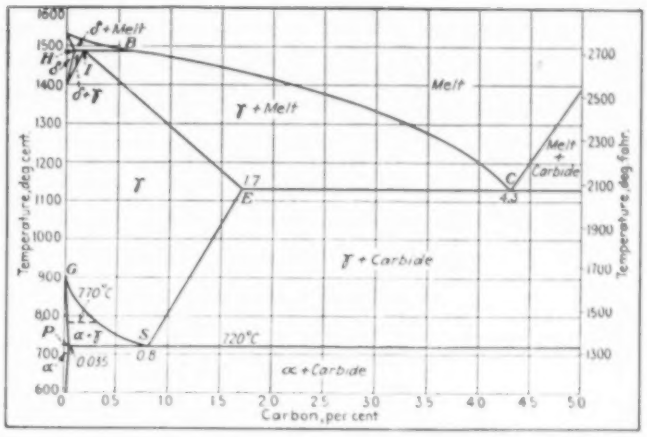


Fig. 46—Iron-carbon diagram confined to the iron-cementite, or metastable system, from Alloys of Iron and Silicon

To simplify the problem, usually an attempt is made to modify the binary diagram of the two major components so that the effects of a definite amount of the third component are shown clearly. In that way it is possible to show some of the effects of silicon on the iron-carbon diagram by a series of modified iron-carbon diagrams, one for each percentage of silicon so considered.

In some cases the addition of a third element results in formation of a structural component which exists within the metal as a more or less distinct entity. It is segregated in the form of an element, a compound or of an eutectic, any of which may be but slightly soluble, and its influence often may be regarded more or less as an inclusion effect once it has formed.

Graphite in gray iron, which may be regarded in itself as an inclusion, is re-dissolved by the matrix under certain conditions. The interdependence of the forms of iron and carbon suggest that graphite formation is a case for separate and special study. Under certain conditions the *steadite* formations, *manganese sulfide* inclusions, etc. can be considered as entities more or less distinct from the iron-carbon-silicon alloys in which they occur. Obviously, this scheme has many limitations and its employment is restricted to formulation of a few illustrations which may make up in vividness what they lack in accuracy.

A conventional iron carbon diagram is shown in Fig. 46, which is confined to the iron-

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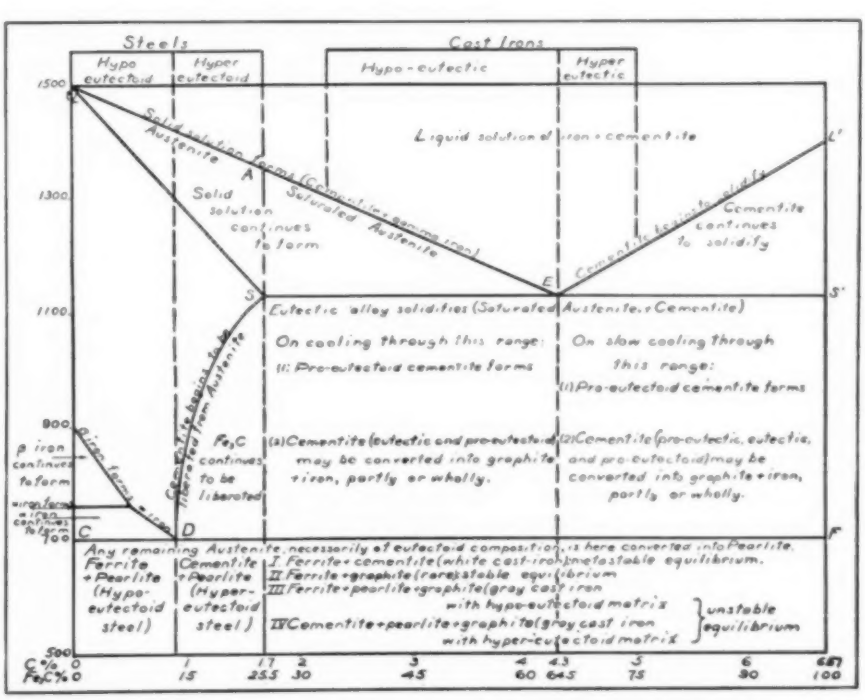

Steels
Cast Irons
Hypo eutectoid
Hyper eutectoid
Hypo-eutectic
Hyper eutectic
Liquid solution of iron + cementite
Solid solution forms (Austenite + gamma iron)
Saturated Austenite
Solid solution continues to form
Cementite continues to solidify
Eutectic alloy solidifies (Saturated Austenite + Cementite)
On cooling through this range:
On slow cooling through this range:
Fe3C continues to be liberated
Any remaining Austenite, necessarily of eutectoid composition, is here converted into Pearlite.
Ferrite + Pearlite (Hypo-eutectoid steel)
Cementite + Pearlite (Hyper-eutectoid steel)
I Ferrite + cementite (white cast-iron) metastable equilibrium.
II Ferrite + graphite (rare) stable equilibrium
III Ferrite + pearlite + graphite (gray cast iron with hypo-eutectoid matrix
IV Cementite + pearlite + graphite (gray cast iron with hyper-eutectoid matrix
unstable equilibrium

Fig. 45—Equilibrium diagram of iron-carbon alloys, according to Sauveur

What Will Follow NRA?

Future trends in business practices as viewed by leaders in the foundry industry

NO SINGLE legal ruling in American history has had deeper import or more far reaching influence upon business and industry than that handed down by the Supreme Court of the United States, May 27, 1935, relating to the National Industrial Recovery Act. Its political and social implications, the merits and shortcomings of NRA from varied viewpoints and the thousand individual angles from which this decision will be argued in the months and years ahead were dismissed by the editors of THE FOUNDRY, as secondary to the immediate import of the matter to the foundry industry. Accordingly, letters were addressed to fifty foundrymen in an attempt to assemble a cross section of opinion of the industry regarding the immediate future. Names of recognized leaders, men with an industry consciousness and familiarty with the resulting change in trends were selected for this quick interview by correspondence. The resulting replies indicate a fine reaction, a high resolve to hold fast to that which is sound in co-operative action.

Various Meetings Called

Naturally, at the time this is written, June 4, opinion has not been crystallized and opportunity has not been given for the various trade associations or code groups to meet and take action. Various meetings have been called and courses planned. Almost without exception, foundrymen express belief that the matter was decided in a period of declining activity, when industry will have a chance to absorb the shock of change and when precipitate action as to wages, hours and prices is not required. The executive staffs of the various code organizations under the implied wish of the NRA administration in Washington, have discontinued all active code work and several have cut all commitments and released at least a portion of their staffs. A notable inclination to preserve the *status quo* in wages, hours and prices is evident, contrary to the shrieks of anguish directed at isolated cases in other industries, by NRA compliance officials.

The fine spirit of many of the code authority members of the foundry industry, who by the way, unselfishly have made a heavy contribution of time for their industries, is shown by their comments on the subject. Fred A. Lorenz Jr., American Steel Foundries and president of the Steel Founders' society in a bulletin to members says:

> The steel castings industry is fortunate in being relatively close knit and in having a clear understanding of the stabilizing value of co-operative effort. The benefits which have accrued should without difficulty be retained to our industry. The industry can make itself a great power for national good by continued fair treatment of its workers, its customers and its competitors, without threat of legal redress if their fair treatment is not granted.

Similarly, Franklin R. Hoadley, Farrel-Birmingham Co., Ansonia, Conn., president of the gray iron code authority states:

> Industry has a very great responsibility to see that fair wages and reasonable hours of work are continued. The honest and intelligent fulfillment of this duty can be brought about by well organized and well managed trade associations. During the past few years each manufacturer should have learned the great importance of an organized industry. Each of the castings industries has its own special problems and each industry must take its place along with others as a strong integrated unit which can exert its combined influence for those things necessary for its survival.

In the nonferrous industry where NRA gave impetus to the establishment of a trade association where none previously had been possible, the president and chairman of the code authority, N. K. B. Patch, Lumen Bearing Co., Buffalo, says:

> In the nonferrous foundry industry, it has been almost impossible to secure co-operative effort, since the industry is made up of such a vast number of small units, each of which felt that the expense of co-operative activity was out of proportion to any possible benefits. This short experience under NRA will prove to a majority, at least, that such action is beneficial and that such benefits can be derived by trade association or co-operative action as can yield a substantial return on a small investment. We cannot afford to scrap the structure of what we started to build.

R. R. Fauntleroy, Moline Malleable Iron Co., St. Charles, Ill., president of the Malleable

Founders' society, the code group of the malleable branch of the foundry industry affirms his faith in the ability of the industry to maintain its position, saying:

> The malleable iron industry has, from a number of viewpoints, benefitted from NRA. These benefits, I believe, can be retained to the industry through voluntary action. The industry has benefited because its members have whole-heartedly carried out the provisions of the code and further, because the members of its code authority have conscientiously given of their time, which has resulted in *their* operating the code and not Washington.

A realization of the danger of Washington domination of industrial affairs down to the smallest detail is apparent in many of the replies received to the letters sent by THE FOUNDRY. This despite the fact that the questions stated in the inquiry specifically avoided these phases of the NRA intent. A few berated the constitutional lawyers in Congress who framed and voted for a law now declared unconstitutional. One says, "Did they know all the time that the one legged bird was a dummy? Will business get busy now and pull us out of the depression, or will it want some more and other soothing syrup?" Another says, "We may thank God that we still have a bulwark of liberty interposed between us and a small group in Washington, who would, if unchecked, soon get to the point of regulating our meals and our hours of rising and retiring, so that I feel that the nation has gained more than the industry has lost."

Association Can Accomplish More

H. A. White, National Bearing Metals Corp., Pittsburgh, speaking personally and not for his company, believes that the nonferrous foundry association functioning strictly as a trade association and without the threat of government prosecution can accomplish a great deal more than they could under NRA. A salty comment by James L. Wick Jr., Falcon Bronze Co., Youngstown, reflects the same belief when he says:

> My first reaction to the decision was one of joy and gratitude to the framers of our Constitution, who safeguarded us against a central form of government. Moses established a code some years ago in his ten commandments, which did not seem to influence greatly the character and tendencies of the human animal. Neither has NRA in the nonferrous industry, which was denied an approved cost system by the NRA administrator.

However, Mr. Wick believes that the contacts and mutual respect engendered through the code conferences have been beneficial and with a sound nonferrous trade association, these may be retained.

William T. Mellow, Liberty Foundry Co., St. Louis, is another foundryman who feels that undue government influence is bad. He says:

> The Supreme Court decision in declaring NRA void should re-establish confidence among all business men—knowing that now Congress cannot impose undue restriction on industry.

Another says:

> I believe many failed to realize the future implications of the New Deal Plan, which was basically socialistic. It was inevitable that the privileges temporarily enjoyed by certain industries in the way of prices, would have ultimately required more and more government supervision, and it was inevitable that the supervision would have fallen into the hands of politicians not qualified by experience to assume such responsibility over the welfare of industry.

It is noteworthy in all of this discussion bearing upon the removal of governmental control that those who obtained codes early and operated under them most successfully express regret at their passing. Those in the industries which came through the battle of Washington a bit later and were denied certain provisions which they wanted or were obliged to accept others which were distasteful still feel the sting of bureaucratic tendencies not evident in the early days of NRA. Some still chafe under the resentment aroused by late comers in the NRA staff as is noted from the following comments of a foundryman, who asks that his name be omitted:

> Like anything else, the NRA was not 100 per cent bad or good. . . . . Its major deficiencies were that it attempted too much and ran into unnecessary detail. . . . . Next came the handling of the people with whom NRA dealt. This was done with such obvious insincerity, in such a manner as to cause people who went to Washington, prepared to deal sincerely with the government, to realize quickly that they were being black-jacked whenever possible, that the main object was an establishment of a self-perpetuating bureau. . . . . and finally the fact that everyone who came before it was regarded as a criminal and a thief was shown very plainly by that attitude.

Retain Meritorious Features

All this comment, emphasizing some of the apprehension of the spreading power of NRA over private affairs, was unsolicited, and is quoted only as a reaction apparent at the first announcement. The majority of those interviewed are relieved at the removal of the threat of government domination. However, the main purpose of the checkover of sentiment was to ascertain the probable immediate effect upon wages, hours, trade practices, costs and prices. Undoubtedly, it is too early to predict, but the opinion seems to prevail that every effort will be made to retain the merits of the codification of the foundry industry.

With surprising unanimity, but true to the accepted tradition of the foundry industry, employers express concern for the unemployed and announce their intention of sustaining wage and hour standards. The (*Please turn to page* 81)

Bathing Beach, Centre Island, Toronto

Picnic Grounds, Centre Island, Toronto

Sailing on Toronto Bay

Lagoon, Island Park, Toronto

Toronto Convention To Vacation

WHILE committees of foundrymen from Toronto and the surrounding territory are making final plans for the reception and entertainment of visitors at the annual convention of the American Foundrymen's association in that city, Aug. 20 to 23, and the headquarters of the association are completing the technical program for the gathering, foundrymen throughout the country are considering combining convention attendance with an excellent vacation. Not for years has the annual convention of the A.F.A. offered such unusual opportunities for a most enjoyable vacation.

Year by year, Canada has become better known as the summer play ground of North America. From early summer until late fall, thousands of families journey into the north to enjoy the many resorts or to hunt or fish in the lakes or streams with which the country abounds. With the convention in Toronto scheduled for the season when the trek north is at its height, the invitation of Canada to spend some time in its vacation country, either before or after the convention, will be accepted by many.

Entertainment Feature Plentiful

Toronto, in addition to being one of the important commercial centers of the Dominion, provides almost unlimited facilities for the entertainment of the summer visitor and in itself is a splendid vacation resort. Sunnyside, one of the finest waterfront boulevard developments in the world, which was created with sand from the bottom of Lake Ontario, provides one of America's most attractive amusement parks. Every type of summer amusement is provided, including a fine bathing pavilion operated in conjunction with one of the worlds largest heated swimming pools. Other fine beaches are available.

Golfers will find Toronto a most inviting city, for few, if any cities can boast of finer courses. Thirty-two 18-hole courses provide a golfer's paradise. The 1935 convention city also is well supplied with many modern hotels, two with over 1000 rooms each, being among the largest and finest on the continent.

The city has many points of interest for the vacation visitor, including the Parliament buildings; the University of Toronto; the Royal Ontario Museum; Old Fort York; Art Gallery of Toronto; Riverdale Zoo; City Hall; Allan Gardens; and the Canadian National Exhibition Park. Side trips may be made by steamer or

Invites Visitors In Canada

Thirty-two Beautiful Golf Courses in Toronto

One of the World's Largest Heated Swimming Pools, Sunnyside

Having a Good Time at Sunnyside Beach, Toronto

Sunnyside Beach and Bathing Pavilion, Toronto

motor bus to Niagara Falls, and rail service and motor bus routes are provided to Muskoka Lakes; Lake of Bays and Georgian Bay summer resort sections, and also to the Kawartha Lakes section.

The tentative program for technical sessions at Toronto, recently announced by Robert E. Kennedy, technical secretary of the A.F.A., is as follows:

Monday, Aug. 19

Committee Meetings

Tuesday, Aug. 20

10 to 11 a. m.	Opening meeting.
11 to 1 p. m.	(a) Cast Iron.
	(b) Foundry Sand Research.
Afternoon	Plant Visitation.
8 to 9 p. m.	Sand Shop Course.
9 to 10 p. m.	Cast Iron Shop Course.

Wednesday, Aug. 21

9 to 11 a. m.	(a) Malleable Cast Iron.
	(b) Materials Handling and Foundry Equipment.
11 to 1 p. m.	(a) Cast Iron Metallurgy.
	(b) Foundry Refractories.
Afternoon	Plant Visitation, Golf, Sight-seeing.
8 to 10 p. m.	Silicosis and Employer Responsibility.
8 to 9 p. m.	Cast Iron Shop Course.
9 to 10 p. m.	Sand Shop Course.

Thursday, Aug. 22

9 to 10 a. m.	Cast Iron Shop Course.
10 to 11 a. m.	Sand Shop Course.
9 to 11 a. m.	(a) Steel Founding.
	(b) Nonferrous Castings.
11 to 1 p. m.	(a) Apprentice Training.
	(b) Cast Iron (Centrifugal Casting).
1:15 to 3:45 p. m.	Round Table Luncheons.
	(a) Steel.
	(b) Malleable.
	(c) Nonferrous.
	(b) Cast Iron (Centrifugal Casting)
4 p. m.	Annual Business Meeting.
7 p. m.	Annual Dinner and Reception.

Friday, Aug. 23

9 to 11 a. m.	(a) Steel Founding.
	(b) Cast Iron.
11 to 1 p. m.	(a) Dust Control and Safety Codes.
	(b) Nonferrous Founding.
Afternoon	Canadian National Exposition.

The program presents several innovations in scheduling. On both Tuesday and Wednesday, sessions will be completed at 1 p.m., and the afternoons will be open for plant visitation, sight seeing or other entertainment features which may be suggested by the Toronto committees. On both days, shop courses will be held in the evening, starting at 8 p.m. Scheduling the practical shop courses at that time will permit many foundrymen in Toronto and vicinity, who may find it difficult to attend sessions during the day, to include this feature.

Production of high test cast irons in the cupola offers a wide field for study and development, in the opinion of the author

FOUNDING HIGH TEST CAST IRON

By W. R. JENNINGS
Ecorse Foundry Co., Ecorse, Mich.

THE fundamental problem of the foundry still consists of making castings that will stay sold; producing heat resistant castings that will resist heat, providing wear resistant castings that will resist wear, manufacturing alloy castings that can be heat treated—and at the same time have the engineering qualities specified.

In founding high test irons the tensile strength of the iron produced is the lowest in the day's operation—and not the highest. We are all prone to talk of the highest strengths which we have been able to make, but from a practical standpoint we must be governed, not by the average, but by the lowest.

What is high test iron? Is it an iron of 30,000, 40,000, or 50,000 pounds? For the purpose of this paper we will consider irons that have a minimum of 30,000 pounds per square inch tensile strength in the high test range.

The first step in making high test irons is a good laboratory, or a close connection with one. The old masters, who could judge the pig by fracture, iron by its density, and coke solely by appearance, are just about gone. The secret of high test irons is contained in the phrase *consistency in practice*. Consistency of pig iron, scrap, steel, coke, melting conditions, volume, and pressure of air—these can be maintained uniformly only by constant check.

Practically speaking, after the laboratory is established, so that we know what we are doing, we will start to work on the melting unit. Of course, a majority of foundrymen are melting in the cupola. It is the writer's opinion that the value of that type of furnace has not been utilized to within 50 per cent of its potential capacity in the making of high test irons. We are all familiar with the cupola and its method of operation, and yet a high strength iron and a weak one can be produced out of the same stack, just 15 minutes apart. It is this difficulty which most foundrymen encounter in making high test iron.

The practical problem is to keep the cupola operation consistent. Carl F. Joseph, Saginaw Malleable Co., at the 1934 short course at East Lansing, presented an able paper on that subject, and on which the writer cannot elaborate, except to reiterate a few points which are vitally important.

Most high strength irons of cupola production

have a total carbon range of 2.90 to 3.35 per cent and silicon of 1.80 to 2.10 per cent. Of course, these ranges will vary according to section and type of castings. A few simple rules must be followed to obtain consistent results. First, use a good grade of coke. Its size may vary from a small lump in a small stack to a large lump in a larger cupola. It must be dense and firm, and with a total carbon of 90 per cent or better. Secondly, materials must be selected carefully. Pig iron from two or more sources is desirable. Scrap-free pig iron should be specified if additional scrap is to be carried. In most sections of the country scrap can be purchased considerably cheaper in the form of scrap than in the form of pig iron. Scrap should be as free from scale and dirt as possible. Steel scrap should be watched closely as a thin, rusty piece of steel can be from 15 to 20 per cent oxide. A piece of steel 1-inch thick will melt at about the same rate as a standard pig. This explains why, in hand charging, lighter scrap should be placed in the center of the charge where the temperature is lowest. Likewise, alloy briquets are best placed in the center of the charge. It will pay to obtain as near uniformity as possible in charging and in materials used.

Height of Coke Bed

Tuyere height also is important. Considerable has been written in regard to the height of a bed of coke above the tuyeres. It is our experience in making high test irons that an important factor is the depth of the hearth or the distance from the tuyere to the sand bottom, or from the slag hole to the sand bottom. This should be kept as shallow as possible, about 8 to 12 inches in the average cupola being sufficient. Use of a forehearth or a receiving ladle so that iron does not remain in contact with the coke in the hearth of the cupola for any length of time—a continuous tap—with no shut downs, is exceedingly desirable to obtain the best control of carbons.

In the average cupola operation, a shut down of 15 minutes will add from 15 to 30 points to the total carbon. If a forehearth or receiving ladle is being used and the metal is allowed to drain from the cupola during the shut down, little change in carbon will be noticed. That method will provide a reduction in sulphur pick up.

Much has been said concerning the effect of sulphur. It is our experience that better machinability or more uniform machinability is obtained if sulphur is kept below 0.12 per cent. The sulphur content seems to tell another story. Where sulphur shows a wide range, due to large steel additions, it may or may not be injurious for a particular iron, but it indicates an erratically operated cupola. If the sulphur content remains fairly consistent with the carbons, the cupola probably is being operated consistently.

Electric furnace melting has the same problems as are encountered with the cupola. The electric furnace may be as erratic as a poorly operated cupola, or it readily can make high test irons obtained with difficulty in the cupola. Here again, the secret in operation is consistency. Raw materials should be standardized. Of course, the foundryman can fool around with poor materials in an electric furnace and dope and slag them until an iron finally is made but he will have fewer wrinkles in his forehead and fewer gray hairs by standardizing on materials. We have been able to operate a cupola throughout a day's run with a spread of 15 points of carbon, and an electric furnace with half of that, but we give the electric furnace a lot more attention than the cupola.

Low Total Carbon Iron

Assume that we have successfully operated the cupola, air furnace, electric furnace, Bracklesburg furnace, and have produced a good hot iron of 2800 to 2950 degrees Fahr. In each case we have a comparatively low total carbon iron. It may be 2.60 per cent for one grade, or 3.25 per cent for another, depending upon section of the casting and type of melting unit. The silicon has been adjusted to suit the carbon content. In any case, we are striving to attain pearlitic structure in all sections of the casting, with no free ferrite, no massive cementite, a finely divided graphite, and a fine pearlitic structure.

The following typical material specification for high test iron recently was issued to cover an iron in a severe application:

1—Microstructure desired has a fine grained pearlite as a matrix. The graphitic carbon shall be unusually small in amount, and shall be evenly distributed in unusually fine flakes. Free ferrite, steadite, or free cementite are not desired.

2—Physical properties are as follows:
Brinell hardness—223-248 throughout the casting
Tensile strength—48,000 pounds per square inch minimum
Transverse strength—5,000 pounds minimum on a 1.20 inch diameter bar, tested on 12-inch centers.
Resilience, accurately figured on transverse test as above must be 425 inch pounds minimum.

3—Chemical analysis shall conform to the following:

	Per Cent
Total carbon	2.90-3.10
Combined carbon	0.60-0.80
Graphite carbon	2.50 maximum
Manganese	0.50-0.80
Phosphorus	0.20
Sulphur	0.09
Molybdenum	0.35

4—Castings must be free from shrinks, blowholes, casting strains, and other imperfections that might affect the strength and toughness, wearing qualities, or appearance.

5—The vendor may modify the chemical specification if necessary (*Please turn to page* 66)

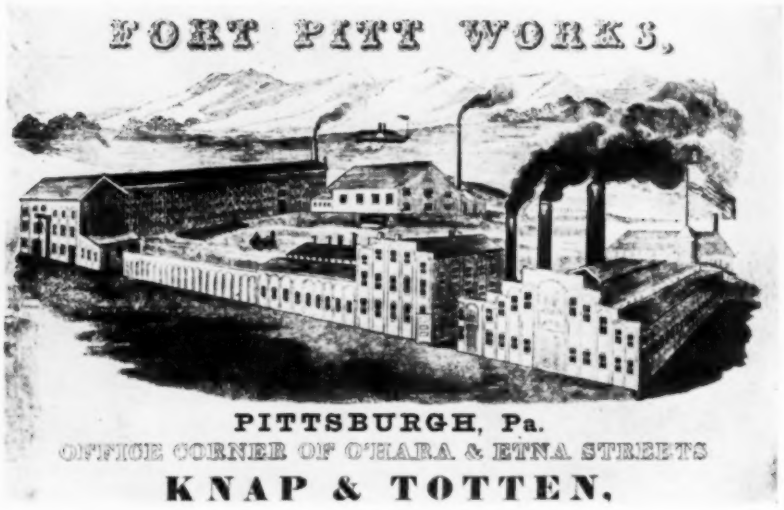


Fig. 1—The Fort Pitt Works was a busy establishment as far back as 1815

Pittsburgh Foundry Cast Guns

Record of pioneering achievement marked the progress of firm for over 130 years

By PAT DWYER

WITH a continuous record of achievement over a period of 130 years, the Mackintosh-Hemphill Co., Pittsburgh, has played an important role in the growth and progress of the iron and steel industry in the United States. The company served the government loyally and well in time of war, and anticipated the needs and produced the equipment required for manufacturing interests in time of war and peace.

The first guns and ammunition from the Pittsburgh foundry enabled Commodore Perry, Sept. 10, 1813, to smash the enemy fleet off Sandusky Bay, and thus regain American supremacy on the lakes. Ordnance and projectiles from the same source, shipped down the Ohio and Mississippi were employed by General Jackson in the battle of New Orleans, fought two weeks after the warring nations had signed the peace treaty in Europe. Communication between Europe and America was not as rapid then as now.

With the exception of occasional peaceable demonstrations, no foreign flag has flown over, and no foreign troops have set foot on United States territory since the war of 1812, but the long roll of the war drum, the screaming bugles have called men to the colors on many occasions at home and abroad since the treaty of Ghent was signed Christmas Eve, 1814. In all the war time activities of the United States for 60 years, whether by land or sea, the old Fort Pitt foundry furnished its quota of cannon and cannon balls.

Iron guns and solid shot in gradually increasing size and weight formed an important part of the company's products until the early eighties when ordnance engineers decided that the practical limitation of gray iron had been reached and attention was turned to the use of steel in the manufacture of big guns. Some idea of the magnitude to which these engines of destruction had been developed during the period of the Civil war may be had from a paragraph in the *Pittsburgh Post* under date of Monday, Feb. 22, 1924 and headed:

Sixty Years Ago

Monday, February 22, 1864—The greatest gun of the age is cast at the Fort Pitt Foundry. The gun is 20 inches diameter with a bore of 210 inches.

Considering the comparatively primitive facilities available at the time, this achievement constitutes an eloquent tribute to the practical and technical ability of the men in charge of the work. The gun and others of a similar character was cast breech down according to a method developed by General Rodman, in which a

stream of water was kept flowing through a coil in the core during the pouring period and for some time afterward.

Following the close of the Civil war, the opening up and settlement of the West, expansion of the railroads and the multitudinous industrial activities incident to supplying the needs of a rapidly growing population, the company turned its attention more particularly to the production of rolling mills and rolling mill accessories. Castings in that particular field had formed part of the product for many years. In a list of *Firsts* published by the company, claim is advanced for the first chilled roll cast west of the Allegheny mountains. Since no record is available for priority east of the Alleghenies it is reasonable to assume that this roll cast in 1823 was the first cast in the United States. The first chill roll patent in the name of James Harley, was issued in 1835. Incidentally the bottom whirling gate feature still recognized as standard practice is one of the items in the patent.

Fig. 2—One of the cannon balls cast for use in Perry's fleet in the war of 1812. The casting is 8 inches diameter and is as solid and clean as it was the day it was cast

The record further shows that the company produced the first chilled roll for rolling brass sheets in 1842, built the first locomotive west of the Alleghenies in 1850 and in 1871 produced the first commercially designed universal mill. The first reversing blooming mill in the United States was built early in the year 1877 for Schoenberger & Co., plant at Sixteenth street, Pittsburgh. In 1882 the company built and introduced the first Garrett rod mill. This type of mill revolutionized the wire rod industry. Two rods were rolled simultaneously and wound on independent power reels. This mill had an annual capacity of 45,000 tons. For many years Mackintosh-Hemphill Co., had no competition in the manufacture of steel rolls for the iron and steel industry. The company made its first steel castings in 1885 and in 1888 built two 58-inch roll lathes for use in finishing the products of its own steel foundry.

Joseph McClurg, No. 1 man on the long personnel roll of the Mackintosh-Hemphill Co., was a young foundryman out of the north of Ireland who arrived in the straggling settlement of Pittsburgh in 1803 and in company with two other men established a foundry. A few years later, 1815 to be exact, the *Pittsburgh Directory* comments complacently and with justifiable pride on this feature:

The town first was laid out in 1765 and afterward laid out and surveyed on its present plan in 1785. The ground plot of the town is triangular, the streets running parallel with each river, which at their junction form an angle of about 33 degrees. The population in 1800 was about 2400 souls. In 1810 the census gave 4740 and in 1815, a calculation based upon what is believed to be correct data makes an estimate of upwards of 9000.

Few places can boast of more useful improvements in manufacture and the mechanical arts than Pittsburgh. It has been justly and emphatically styled the "Birmingham of America." A comparative view of its progress must indeed awaken admiration. Until about the year 1793 an increase was not rapid. In the year 1813 we behold it rich and flourishing, daily augmenting in manufacture and commerce.

There are three foundries in Pittsburgh at which castings of every description from a cannon to a spider are extensively and handsomely executed. In connection with the foundry of Messrs. McClurg and McKnight, N. Side of 5th street, between Wood and Smithfield, is a mill for boring cannon.

Urbanity and dignity characterized early journalists "Castings extensively and handsomely executed!"

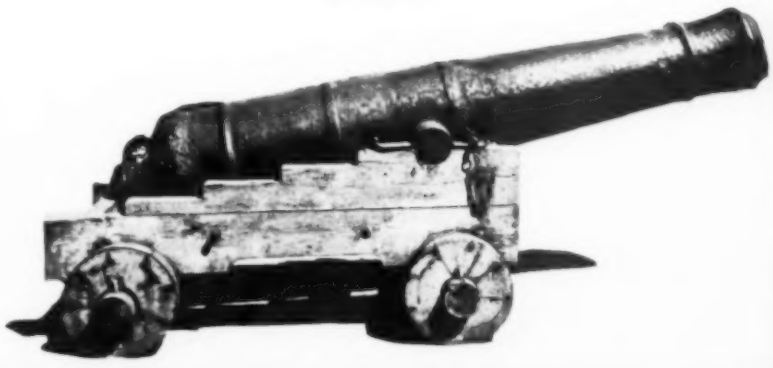
Harking back a few years to 1805 the following notice in the *Pittsburgh Directory* indicates that apparently foundryman McClurg either was dissatisfied with his partners, or, what is more likely decided he would achieve greater success by running the business alone:

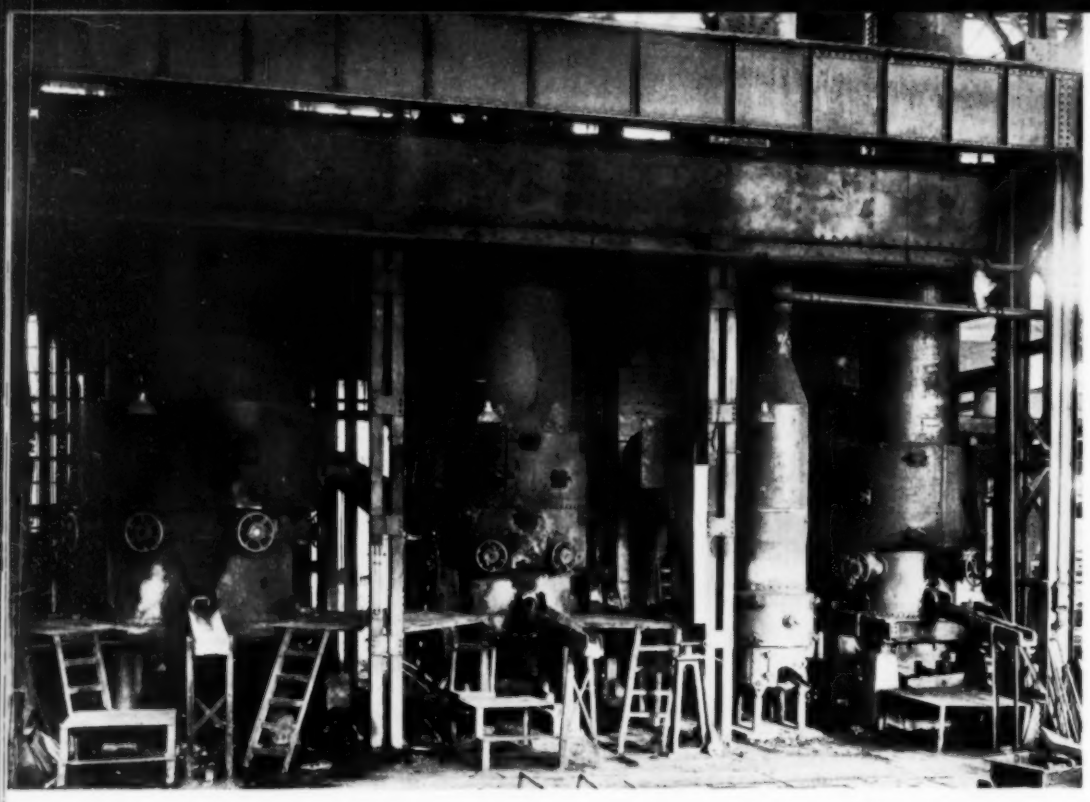
NOTICE

The subscriber, proprietor of the Pittsburgh Foundry having dissolved partnership by mutual consent, therefore all persons having demands against said firm, are desired to bring in their accounts for settlement, and those indebted are requested to pay their several accounts unto Joseph McClurg ** ** Joseph Smith, John Gormly. Joseph McClurg. Pittsburgh, 28th October, 1805.

The subscriber having purchased the Pittsburgh Foundry takes the liberty to inform the public that he intends immediately to commence and carry on said Foundry Business in the Most Extensive Manner, where orders will be received and executed in the best manner by the Public's most obedient and humble servant, Joseph McClurg. November 6. (*Please turn to page* 71)

Fig. 3 (Below)—Type of cast iron naval gun used by rival fleets in engagements on the Great Lakes. This gun has a 6-inch bore and was known as a 32-pounder





Group of four balanced blast cupolas at foundry of International Combustion Ltd., Derby, England. The fourth cupola is in the rear of the unit on the right. The cupolet is too small for conversion

Design of Balanced Blast Cupola

Air supply is controlled at main tuyeres by adjustment of individual valve screws

By F. J. COOK
Birmingham, England

ONE of the outstanding developments in foundry practice in Great Britain during the past 3 or 4 years is the new design of melting furnace known as the balanced blast cupola, which has been introduced by the British Cast Iron Research association. That association, which is a government aided body carrying out research for the benefit of the British foundry industry, always has been concerned particularly with the cupola furnace and with the influence it has on the properties of the metal melted, for its experience has shown that different cupolas yield irons of different properties from similar charges.

Scientific work carried out in the association's laboratories demonstrated that the conditions under which a charge is melted in the cupola, to a large extent, determine the properties of the metal and that the initial charge composition assumes a secondary importance. That work showed the necessity for the highest possible temperatures in the melting zone of the cupola and the greatest possible freedom from oxidation if the best material is to be produced. J. E. Fletcher, on behalf of the association, realized these conditions in this new design which is known as the balanced blast type. In addition to high melting zone temperatures and comparative freedom from oxidation, the new type melts with such a low consumption of coke that the cost of installation is met rapidly out of economies effected.

It is possible, as a general rule, either to convert existing cupolas to that type or alternatively, of course, new cupolas can be designed. The design can be used on cupolas having an internal diameter from 24 to 90 inches. The rated output per hour of the cupola is calculated as 11.6 pounds per square inch of bore area at the tuyeres.

The principle of operation is that of controlling the air supply at the main tuyeres by individual screw valves on each tuyere. These valves are fixed to the wind belt and control the

air supply to the bottom row of tuyeres. In addition two or three rows of small upper tuyeres, all within the melting zone, are provided above the main tuyeres, also drawing the air from the wind belt. These small tuyeres are not regulated like the main valves, but the amount of air admitted at each can be adjusted during the preliminary run, following which they are not altered further.

It is found that there is a setting of the main valves which suits the size and quality of the coke and charges used, and which produces the hottest and best iron with the most economical fuel consumption. The setting of the valve tuyeres determines the extent to which the air supply is divided between the main and the upper tuyeres. Closing the valved tuyeres results in less air through the bottom tuyeres and more through the upper and vice versa, so that the air supply is balanced between the lower valved tuyeres and the upper tuyeres. The results obtained are due not merely to the use of valved tuyeres, but also to the number, size, and distribution of both upper and lower tuyeres, that is to the design as a whole.

Improved Features Claimed

The following features are claimed from the use of the new design:—

(1) Reduced coke consumption, varying in individual cases from 20 per cent to 40 per cent, together with a diminished sulphur pick-up consequent on reduced coke consumption; or, alternatively, the use of a cheaper coke yielding the same sulphur content in the finished castings.
(2) Metal of a high temperature at the spout, from 2550 to 2650 degrees Fahr. throughout the melt.
(3) Hot metal from the beginning of the melt right to the end, avoiding pigging cold metal at the beginning of the melt or a fall in temperature at the end of the melt.
(4) Iron comparatively free from oxidation, lying quietly in the ladle without excessive sparking or ebullition. Slag analyses have shown a reduction of iron loss in the slag.
(5) Rapid removal of frozen slag obstructing the tuyeres without poking.
(6) Successful melting of charges containing large proportions of steel scrap.
(7) Reduction in scrap and defective castings as a consequence of the higher temperature of the metal and its freedom from oxidation and entrapped slag.

No actual figures for the ratio of coke to metal are given because conditions vary widely from foundry to foundry. The precise coke consumption obtained in a cupola depends upon a number of factors, including not only the consumption of the initial charges, such as amount of total carbon and phosphorus present, but also on the size of the scrap melted, quantity and size of steel scrap incorporated in the mixture, quality of coke employed, and so on. Thus foundries making similar castings will not necessarily have the same coke consumptions, and each foundry has to be considered on its merits.

It generally is found that high phosphorus irons can be melted with a lower coke consumption than medium phosphorus irons, and medium phosphorus irons than hematite irons. When steel scrap is melted and where exceptionally hot iron is required, the coke consumption also has to be increased. As previously stated, economies of the order of 30 per cent usually are obtained after conversion to the new design.

Experience has shown that the metal obtained from the balanced blast cupola is superior to that obtained from the ordinary cupola. Because of the fact that it is relatively unoxidized and gas free, it lies quietly in the ladle and mold and this helps considerably in the avoidance of blowholes, shrinkage cavities, etc. In every case a reduction in the number of scrap castings has followed the installation of the cupola and some remarkable savings have been reported. In one foundry where careful records are taken the scrap due to defective castings over 12 months was reduced by 85 per cent of its original figure, averaged over several years, and reductions of 25 per cent to 30 per cent of the scrap figures are common. The cupola has been found to be extremely successful where sinking, drawing and shrinkage have been experienced with the ordinary cupola metal. It is possible to melt large quantities of steel in the balanced blast cupola without affecting the quality of the metal and several firms successfully are melting charges containing up to 50 per cent steel. Higher proportions have been used in special cases.

Cupola Operated Readily

The question may be asked, is the balanced blast cupola more difficult to operate than a cupola of normal design? It can be stated definitely that no case has arisen where the ordinary cupola attendant has been unable to operate the cupola efficiently after the first or second run. After the correct setting of the auxiliary tuyeres, of which there are usually three rows in the wind belt, has been decided on, there is no necessity for altering these tuyeres. The adjustments made to the main valves during the melting period are simple and gages easily can be made to check up the settings periodically.

The cupola requires little attention even during long runs and a slide shutter which is provided above the main tuyeres enables each of these to be shut off for a short time in rotation. This allows any slag which has frozen over the tuyere mouths to be melted and in most cases completely obviates the necessity for poking the tuyeres. The balanced blast cupola easily can be kept clean and free from obstructions and no case has been reported (*Please turn to page* 72)

Questions and Answers

Covering modern foundry practice

This department includes problems relating to metallurgical, melting and molding practice encountered in making castings. Questions from subscribers addressed to the Editor of The Foundry will be answered by members of the editorial staff, supplemented where occasion requires by the advisory staff.

Casting Must Reach Temperature of Molten Tin

We are trying to tin cast iron but so far have not met with success. The surface of the articles after tinning is rough. Is there any process for smoothing the surface after the article has been tinned? Do you recommend sandblasting or dipping in hydrofluoric acid before tinning?

While we are not sure just what you mean by a rough surface, it strikes us that you probably do not leave the articles in the bath long enough so that the castings reach the temperature of the molten tin. That practice is essential in obtaining a smooth uniform coating of tin. In preparation of castings for tinning, we believe that the best results will be obtained through sandblasting. Then the castings are dipped in a muriatic pickle composed of 1 part of acid and 1 part of water, and dried without rinsing in an oven. Only pickle as many castings as desired to tin during the day, since they tend to rust if left overnight without being kept fairly warm.

Just before tinning the castings are dipped in a light acid pickle containing 1 part of muriatic acid and 20 parts of water, and then transferred to a fluxing bath composed of excess zinc dissolved in muriatic acid. From the fluxing bath the castings are immersed slowly into the first tinning or roughing kettle. That kettle should be maintained at a temperature from 500 to 525 degrees Fahr., and the castings are allowed to remain in it for a time sufficient to bring them to the same temperature. The roughing kettle is covered with a zinc chloride and salammoniac flux to the depth of about ½ to ¾-inch.

Castings are removed from the roughing kettle and placed in the finishing kettle which is maintained at about 400 degrees Fahr., and allowed to remain long enough to drop to that temperature. Then they are removed, given a shake to remove the surplus tin, and quenched in a kerosine oil bath. When cool they are washed in hot water, and dried in sawdust. The flux used on the finishing kettle is beef tallow.

German Silver Requires High Pouring Temperatures

We will appreciate any information on the casting idizers and amount, fluxes, remelting porous metal, and and melting of German silver, including data on deoxmelting practice.

Due to its high nickel content, German silver melts at a much higher temperature than in the case of ordinary brasses and bronzes, and naturally should be poured at higher temperatures. Consequently, furnace equipment should be such that a higher temperature can be obtained and maintained so that the metal can be melted rapidly. If the melting equipment is inefficient so that melting is slow, German silver, like any nonferrous alloy, will give considerable trouble from porous castings, due to the absorption of gases.

The deoxidizer employed usually is manganese-copper (30 per cent manganese), the amount ranging from 2 to 4 ounces per 100-pounds of metal. The deoxidizer is added about 5 minutes before pouring. In some cases, the flux used is borax in connection with charcoal, while in others, a flux composed of 4 parts of dry slaked lime and 1 part of fluorspar is used. The quantity used is about 2 to 4 per cent of the weight of metal.

Due to the higher pouring temperature, a good grade of refractory sand should be used, and to obtain a smooth surface, it is advisable to use a facing sand containing a fair amount of new sand.

Avoid Hard Castings By Increasing Silicon Content

We are making gray iron castings containing 2 to 2.25 per cent silicon for general machinery castings, but we cannot seem to obtain a total carbon higher than 2.80 to 2.95 per cent. Our foundry is located in South Africa and is 6000 feet above sea level. Our cupola is 30 inches in diameter and melts 3 tons per hour for a 2-hour period. The coke bed is placed 20 inches above the tuyeres, and the air volume used is 120,000 to 135,000 cubic feet per hour to allow for

the high altitude. One thousand-pound charges with 100-pound coke splits are used. The castings at present are machinable, but on the hard side. We believe that if the carbon could be raised to 3.20 to 3.50 per cent that such trouble would be eliminated.

Undoubtedly, your castings would not be on the hard side if the carbon content was increased, but it seems rather odd that you desire an increase when almost everyone else is trying to obtain the lower carbons. We believe that you can obtain more machinable castings by increasing the silicon content, without worrying about the carbon content. Try increasing it so that the range is from 2.25 to 2.50 per cent, and observe the results. The metal you now are producing seems to be a good, tough iron, and if proper attention is paid to machine feeds and speeds, and cutting tools that the clamor about machinability will be eliminated.

Increasing the carbon can be accomplished by increasing the coke bed in the cupola to at least 24 inches above the tuyeres. Twenty inches is quite low, as experience of many indicates that 24 inches is the minimum, and that height should prevail after the bed is burned through well. After some calculation, it also appears that your blast is rather high, even though your location is at a high altitude.

Casting Defect Is Due To Slag Floating on Bath of Metal

We are forwarding a sample of the material caught in the basin of a skim gate. The gates apparently do not catch all. Some of the material enters the molds and shows up as dirty spots on the castings. We skim the ladle at the furnace and also at the mold. There is no sign of a wash or cut in the sprues, gates or mold. We have fluxed with limestone and soda ash and have varied the charge from 400 to 1000 pounds in a 26-inch cupola. Blast is supplied by a 30-inch fan running at 1800 revolutions per minute.

The sample of material submitted is slag and would seem to indicate first that you are producing altogether too much slag in the melting process, and second, that you are not removing all the slag from the metal before it enters the mold. With reasonably clean iron no fluxing agent is required if the cupola is in operation only about 1 hour during which a 26-inch cupola should melt approximately 4000 pounds of iron. If the cupola is to remain in operation for a longer period about 80 pounds of limestone per ton of iron will keep the cupola clean. On long heats the cupola should be slagged, preferably through a hole in the back.

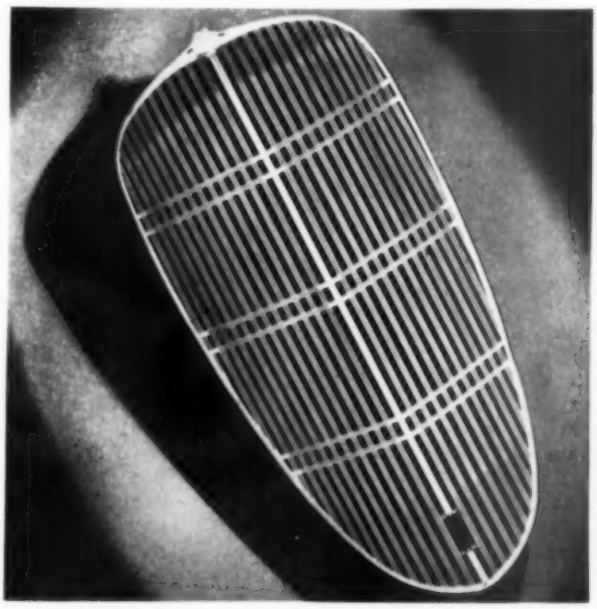
Slag floats on top of the iron in the cupola, and runs out with the iron, if the cupola is drained at every tap. The better way is to stop the tap hole before the last iron appears. If practical in any given instance it is advisable to collect the iron in a reservoir ladle under the spout and fill the other ladles from this stationary ladle. In this manner any slag held in the metal has a chance to rise to the surface from which it may be skimmed. On exceedingly hot iron the slag remains in a molten condition on the top and cannot be distinguished from the iron. A light splash of water on the surface will chill this slag film and either hold it in place, or facilitate its removal with a skimmer.

Gases Pushed to Center Causes Discoloration of Metal

We are sending a brass valve casting which has been fractured at a point of leakage. The fracture shows a marked discoloration. The alloy is approximately: 83 per cent copper, 7 per cent lead, 7 per cent tin, and 3 per cent zinc. Metal is melted in a crucible and the casting is poured direct from the crucible. Will you kindly give us your opinion as to the cause of this discoloration at the point in the casting which seems to be porous?

This is exactly the kind of fracture that commonly is spoken of as indicating burnt metal. However, it is nothing of the kind. The discolored section was the last to solidify. As the other sections of the casting solidified, they forced the gases that were dissolved therein to follow along until they finally were entrapped in the last metal to solidify, opening up small cavities of microscopical size, which became discolored and produced the discolored fracture exhibited in your castings.

You will see that this trouble is caused by the presence of dissolved gases in the molten metal and these gases are present because of improper melting. Did you hold the metal in the furnace an undue length of time awaiting completion of



The Oldsmobile radiator grille is a one-piece, die casting of a zinc alloy. Illustration courtesy of New Jersey Zinc Co.

molds? Is your melting time excessively long for any other reason, such as an undue proportion of borings; too large crucibles for the size of the furnace, thus reducing the speed by reason of inadequate combustion space? Was there an improper ratio of fuel to air? If coke fired furnace was used, was the draft inadequate to insure complete combustion of the fuel?

Chilled Sprocket Wheels Crack in Spokes

We are having trouble with a sprocket wheel 20 inches diameter poured from soft iron in a chilled mold. The iron mixture is made up of 700 pounds pig iron and 800 pounds scrap. To overcome the trouble we have changed the arms to a web center, but the trouble persists. The wheels crack between the spokes, the rim separates, sometimes the spokes crack. We have left them in the molds, we have taken them out hot. We have placed them in a hot ladle to cool slowly but without result. We shall appreciate any suggestion.

Obviously the casting cracks because some factor prevents normal contraction and may be due to the composition of the iron or the construction of the mold. Since your letter presents no specific data on either of these features we merely can offer an opinion from two standpoints. If by a chill mold you mean a complete metal mold, then the cracked casting is directly traceable to the bead or ridge on the upper and lower sides of the rim. Naturally the light rim cools before the comparatively heavy hub. The rim commences to contract but is hindered by the bead. Later the hub cools and exerts a pull on the arms and the result is that either the arms or the rim cracks open. If our supposition is correct an all metal mold, the trouble may be overcome by turning a groove in the mold and inserting a ring core to form the bead. The sand will *give* and allow proper contraction of the casting.

However, if by a chill mold you simply mean a green sand mold with a chill around the rim to chill the working faces of the teeth, your trouble is due partly to the design of the pattern—which probably cannot be changed—and partly to the composition of the iron. As in the first instance the rim of the wheel cools much more rapidly than the center. It cannot contract normally due to resistance set up by the arms and hub and therefore remains in a state of tension. Later the hub and arms start to pull and that either cracks the arms or the rim. The remedy for this condition is to use iron which will stretch a little. You do not give the analysis of the pig iron at present in use but we assume that it is the usual Foundry No. 2. The scrap probably is the usual miscellaneous scrap. While perfectly satisfactory, so far as the utility of the casting is concerned, this iron will not *stretch*. The necessary factor, in this particular case may be introduced by substituting charcoal iron or bessemer iron for the regular pig iron. Bessemer iron, as you probably are aware, is low in phosphorus and sulphur and is used almost exclusively in the manufacture of ingot molds, which are exposed to constant rapid expansion and contraction. If you are in a position to secure a quantity of ingot mold scrap, you can make the entire charge of this material. As a further precaution it may be advisable to strip the hub and dig out the core immediately after the casting has solidified.

Higher Temperature Permits Scum to Rise

We are sending you a casting made of ingot yellow brass. The flat or dirty side is the cope side. Every once in a while we run into this same trouble and we are at a loss as to what is the cause. The brass is 75.40 per cent copper; 2.43 per cent tin; 4.20 per cent lead; 0.18 per cent iron; 0.23 per cent nickel; 17.56 per cent zinc by difference. We melt in coke pit furnaces. Care is taken in keeping the metal covered with charcoal. Sometimes a small piece of aluminum is added before pouring, when the work is real thin. Dross shows up in the finished casting in both cases. Our flux is made up of equal parts of manganese dioxide, boracic acid crystals, soda ash and salt. About one ounce of this flux is put in the pot at the start with charcoal.

The yellow brass did not remain liquid long enough to permit the scum to rise to the skin and be removed by a skin cut in machining. This is proof that the metal when poured was not sufficiently fluid to permit this scum to rise. Of course, to increase the temperature sufficiently to make it more fluid, increases the metal loss, zinc spots and smoke troubles. However, the metal should have been well stirred, given sufficient time for the scum to rise and then skimmed before pouring. Presence of a small amount, say 1/10 of 1 per cent, of aluminum would have helped this casting by increasing the fluidity, but the aluminum should be put in last, just before pouring. If these castings are to be subject to water pressure, aluminum is not permissible. In that case other methods must be pursued to insure sufficient fluidity such as: Higher pouring temperature; filling the mold rapidly by pouring strong; increasing the thickness of the flange by lagging the patterns so that more metal and consequently more heat is available in the section where the scum accumulates, thus permitting the scum to have time to rise to the skin.

Care should be taken that the mold is well vented and the sand is worked as dry as possible. No doubt that has been your regular practice because the rest of the casting indicates good foundry practice.

We cannot discuss the use of a flux, such as you describe, as we have had no experience. Your experience with this flux may indicate that it helps in the production of your castings, and if so, there is no reason why you should change this practice. The fact that you have defects, such as shown in the sample, only occasionally, is indicative of the fact that your regular practice can produce good castings and it is only occasionally that something occurs, such as cold metal or some other cause which does not permit the metal to free itself of the scum before setting.

It is difficult to avoid such defects as are shown in the sample in yellow brass and many manufacturers now are making them in red brass where the increased cost of the red brass over the yellow is more than made up by the reduction in cost of defective castings.

Plate Gives Colors For Painting Patterns

Where can I secure a colored illustration showing the standards adopted by the American Foundrymens association for painting patterns.

Copies of the pattern color chart in large size suitable for posting in the foundry or pattern shop may be ordered from the American Foundrymens association, 222 West Adams street, Chicago. If you have a back file of THE FOUNDRY you will find that this color plate was published as Data Sheets No. 625 and 626 in the June 15, 1926 issue.

You will find further reference to the subject on page 115 in the April 1, 1930 issue of THE FOUNDRY. The color plate and accompanying explanatory text is incorporated in The *Foundrymans Handbook* published by the Penton Publishing Co., Cleveland. This book of 574 pages contains a digest of rules, formulas and tables in constant use in modern foundry operation, practical information essential to the foundryman, patternmaker, metallurgist and student.

The color chart also is included in a publication issued by the United States department of commerce, bureau of standards, Washington, under the title *Foundry Patterns of Wood, Commercial Standard* CS19-30.

Viewing Foundry Developments

At Short Range

REFRACTORIES shaped to provide bottom pouring facilities with ordinary ladles, now are available for hand ladles, bull ladles, and crane ladles. The refractory box simply is pressed into the mud in the green lining to a depth of ¼-inch, dries there and is held in place until the lining burns out.

* * *

A plastic bearing bronze results when less than 0.10 per cent calcium is added to an alloy containing from 40 to 50 per cent lead and 60 to 50 per cent copper according to a patent. The range of calcium is from 0.02 to 0.07 per cent and is added to the molten lead-copper alloy as calcium-copper or calcium-lead. The bearing metal is designed specifically for soft steel automobile crankshafts.

* * *

MOLYBDENUM in amounts from 2 to 4 per cent added to "18-8" steel is said to enhance general corrosion resistance against many chemicals, raise the strength at elevated temperatures and provide a strong inhibitor against inter-granular attack when used in a properly balanced analysis.

* * *

An oxidizing bath composed of 60 parts of caustic soda in 100 parts of water to which after raising to the boiling point 2 parts of trinitrotuluol or trinitrophenol and 0.8 parts of lead dioxide are added, and then after becoming cold 2.95 parts of nitric acid is added, is said to provide a solid black on iron, steel and cast iron. Previous to placing in the oxidizing bath, the castings are freed from grease in 10 to 20 per cent, hot caustic soda and pickled in 5 to 10 per cent sulphuric or hydrochloric acid at 260 to 300 degrees Fahr. for 20 to 30 minutes. In the case of cast iron and alloy steels, a second pickling in 10 per cent hydrofluoric acid for 10 to 45 minutes is employed. For rustless steel, the oxidizing bath may be composed of 100 parts of water, 16.65 parts of caustic soda, 2.33 parts of sodium nitrate and 2 parts of lead dioxide.

* * *

AN ALUMINUM alloy containing from 3.5 to 4.5 per cent copper, 1 per cent maximum iron, 1.8 to 2.3 per cent nickel, 0.7 per cent silicon maximum, 1.2 to 1.7 per cent magnesium, 0.3 per cent manganese maximum, 0.1 per cent zinc maximum, may be heat treated as follows: Heat the castings at a temperature of 930 to 970 degrees Fahr. for 6 hours in the case of small castings, longer in the case of large castings, and follow by quenching in boiling water. Aging is completed in 5 days if left at room temperature or by allowing the casting to remain in boiling water, aging will be completed in two hours. With sand castings, this should give a metal with over 33,000 pounds per square inch tensile and a brinell hardness of about 100.

* * *

The new medium-priced Lincoln is expected to have a V-12 engine which is virtually a Ford V-8 with four additional cylinders. A block will be cast in one piece and the cylinder heads will be cast aluminum.

* * *

A malleable company recently insulated an annealing oven, which resulted in a saving of 29 per cent in fuel consumption, or a total of $308 a year.

* * *

A southern car wheel foundry reports good results in four instances where Haynes Stellite has been applied for hard facing. Wearing shoes on molds formerly were replaced every 60 days but now last a year. Teeth on pit tongs formerly were dressed by the blacksmith every 90 days whereas the present teeth last a year, and then are reground and placed in service. Wheel cleaners formerly lasted 90 days, but hard surfacing increased their life to one year. Sand plows formerly were replaced every 60 days, but the rebuilt plows last a year.

* * *

A permanent mold composed of cast iron and refractory material for production of brake shoes, according to a patent, has many advantageous features. It is arranged in a frame so that it lies horizontally for positioning cope and drag, and vertically for pouring.

* * *

CORING small holes in heavy castings usually is accomplished with difficulties in removing the core material. However, according to a recent patent, those can be overcome by using a steel pipe wound with wire. The specific application is in

steel castings where it was successfully applied in providing ¼-inch holes in a heavy casting over 4 feet long. Composition of the pipe and wire used should be the same as that of the casting. Size of wire and space between winding is such that the wire will be fused completely, but prevent metal from cutting through the pipe.

The FOUNDRY Family Photograph Album

Meffett Studio

Upper Left
S. A. NORRICK
Perfect Circle Co.,
Newcastle, Ind.

Upper Right
S. G. McALLISTER
International
Harvester Co.,
Chicago

Lower Left
S. S. FAIR
Valley
Steel Castings Co.,
Bay City, Mich.

Lower Right
ANTON TANZER
Frank
Foundries Corp.,
Moline, Ill.

Men of Industry

Whose Activities Are Making Foundry History

ALFRED W. GREGG, formerly general superintendent, Bonney-Floyd Co., Columbus, O., has been made works manager, Farrel-Cheek Steel Foundry Co., Sandusky, O. Mr. Gregg was graduated from Purdue university, Layfayette, Ind., in chemical engineering in 1903 and received his masters degree in 1904. Prior to his connection with the Bonney- Floyd Co., Mr. Gregg spent 5 years as foundry superintendent for the Whiting Corp., Harvey, Ill., and 15 years with the Bucyrus-Erie Co., South Milwaukee, Wis., starting as metallurgist and holding successively the positions of furnace superintendent, foundry superintendent and general superintendent. Mr. Gregg is the author of several papers dealing with melting furnace practice and heat treating in the production of alloy steels.

CARL O. HEDNER, Yale & Towne Mfg. Co., Philadelphia division, recently was elected chairman of the Electric Hoist Manufacturers' association.

O. E. MOUNT, secretary and assistant treasurer, American Steel Foundries, Chicago, has been elected president of the Illinois Manufacturers' Costs association.

H. B. KNOWLTON, metallurgical engineer, International Harvester Co., Chicago, has been elected chairman of the Chicago chapter of the American Society for Metals.

HERMAN FLEISHOUR, formerly connected with the W. A. Jones Foundry & Machine Co., Chicago, has accepted a position with the Frank Foundries Corp., Moline, Ill.

GEORGE BEAN, formerly general manager of the New Britain plant, Eastern Malleable Iron Co., which recently has been closed, has been made director of sales of the company which has its headquarters in Naugatuck, Conn.

T. RICE DAVIS, general manager of the Bridgeport plant, also closed, has been made director of manufacturing. EMIL MANNWEILER, for some years general manager of the Naugatuck plant has been named director of specialty products. JAMES L. LINSLEY, formerly purchasing agent and assistant manager of the Naugatuck plant has been made director of sales research, his duties to include development of new products for manufacture.

ALBERT C. BRUCE, president, United States Hoffman Machinery Corp., New York, has been named to the board of directors, Worthington Pump & Machinery Corp., Harrison N. J.

W. B. SULLIVAN, a pioneer in the development and manufacture of heat and corrosion resistant alloy castings and an organizer of Michiana Products Corp., Michigan City, Ind., has joined the alloy department of Lebanon Steel Foundry, Lebanon, Pa.

DAN LEWIS has been appointed manager of the roll department, Continental Roll & Steel Foundry Co., East Chicago, Ind., with headquarters at the Grant building, Pittsburgh.

W. E. CADMAN has been named assistant manager, located at Hubbard Steel Foundry division, East Chicago, Ind.

HATSUO DODO, engineer with the Japan Nickel Information bureau, Shiseikaikan, Hibiya Park, Tokio, and vice president of the Japanese Foundrymen's association, is spending several months visiting in the United States. Mr. Dodo will attend the annual convention of the American Foundrymen's association in Toronto, Aug. 20 to 23.

D. B. PERRY has been elected president of the Morse Chain Co., Ithaca, N. Y., and Detroit, division of the Borg Warner Corp. Other officers include: Vice president, general manager and treasurer, C. J. KENERSON; secretary and assistant general manager, N. K. VAN OSDOL; assistant secretary and assistant treasurer, S. B. WARING; and sales manager of the automotive division and manager of the Detroit plant, FRANK M. HAWLEY.

JAMES T. DUFFY JR., has been made president, Read Machinery Co., York, Pa. Mr. Duffy has served as general superintendent, Thompson Products, Detroit, and later as general manager of the Nice Ball Bearing Co., Philadelphia. Recently he maintained a private practice as a management engineer.

VERNON H. SCHNEE recently has been appointed to the staff of the Battelle Memorial institute, Columbus, O. Mr. Schnee was graduated from Cornell university, Ithaca, N. Y., in 1919, and has had a wide experience, especially in the application and development of inhibitors, lubricants, and nonferrous alloys.

R. E. APTEKAR, formerly consultant on foundry practice, molding sands and refractories, recently has become associated with the American Brake Shoe & Foundry Co., New York, in its operating division. Former connections of Mr. Aptekar include the Ford Motor Co., American Radiator Co., and the Autostrag of the U. S. S. R.

W. H. SPENCER, formerly plant metallurgist, American Cast Iron Pipe Co., Birmingham, Ala., has been made foundry superintendent and chief metallurgist of the Sealed Power Corp., Muskegon, Mich. Mr. Spencer attended the schools of Mobile, Ala. and graduated from Vanderbilt university in 1926. He then became connected with the melting department of the American Cast Iron Pipe Co., leaving that organization in 1928 to become superintendent of the foundry laboratory, engineering department, University of Illinois, Champaign, Ill. A year later he returned to the American Cast Iron Pipe Co. as plant metallurgist. Mr. Spencer is co-author of

an Illinois Engineering Experimental station bulletin, and several papers presented before the American Foundrymen's association. He is a member of the A.F.A. and the A.S.T.M.

SAMUEL S. FAIR (see THE FOUNDRY Album on page 38), is president of the newly formed Valley Steel Castings Co., Bay City, Mich., which has taken over the foundry of the Industrial Brownhoist Corp. of Bay City. Mr. Fair long has been identified with the foundry industry, starting as a young man in his father's iron foundry, and following that branch of the castings business until 1909, when he entered the steel foundry industry. His son, Mendel A. Fair, secretary-treasurer of the Valley Steel Castings Co., has been associated with his father in foundry work for 8 years.

C. B. SCHNEIBLE, recently in charge of Chicago district sales for the American Foundry Equipment Co., Mishawaka, Ind., has resigned to devote his entire time to the sale of wet dust collectors of his own design.

E. B. RICH has been placed in charge of the Chicago office of the American Foundry Equipment Co. with territory extending from Minneapolis to St. Louis. His headquarters are at 605 West Washington boulevard, Chicago. Mr. Rich has been connected with the American Foundry Equipment Co. for some time in engineering, manufacturing and sales work, and for the past 16 months has been working with Mr. Schneible in the Chicago territory.

DR. L. W. EASTWOOD, formerly assistant professor of metallurgy, Michigan College of Mining and Technology, Houghton, Mich., has accepted a position on the research staff of the Aluminum Research Laboratory, Cleveland.

Dr. Eastwood received a degree of bachelor of science in metallurgy from the University of Wisconsin in 1929, and a Ph.D. degree from the same university in 1931. In October of that year, he joined the faculty of the Michigan College of Mining and Technology as instructor in metallography. During his work there he was actively engaged in research and has prepared numerous papers describing the results obtained in that work. Under CWA and ERA grants to the college, an extensive investigation of the effects of copper and copper-manganese in gray cast iron was undertaken under Dr. Eastwood's direction. A paper, "Copper and Copper-Manganese Gray Cast Iron," recently was prepared by him and two associates, A. E. Bousu and C. T. Eddy, describing results of that investigation.

MAURICE F. HOLAHAN, recently vice president in charge of domestic and Canadian sales for the International Harvester Co., Chicago, has been made first vice president, succeeding Sydney G. McAllister, who was elected president a short time ago. Mr. Holahan has been identified with the farm implement industry since 1892, having been made manager of the International Harvester Co.'s Atlanta branch in 1903. He was transferred to the general office in Chicago in 1919 and was made a vice president in 1933.

FOWLER MCCORMICK has been elected second vice president and continues in charge of foreign sales. CHARLES R. MORRISON who has been director of domestic and Canadian sales, has been elected vice president. JOHN MORRIS JR. also has been elected a vice president, having charge of purchasing and traffic.

A. F. A. Nominates Officers and Directors

The nominating committee of the American Foundrymen's association recently met in Detroit and nominated the following for the respective offices in the association for the coming year: President, Dan M. Avey, editor, THE FOUNDRY, Cleveland; vice president, B. H. Johnson, assistant to the president, R. D. Wood Co., Philadelphia; directors, 3 year term, Henry S. Washburn, president, Plainville Casting Co., Plainville, Conn.; Lamar S. Peregoy, president, Sivyer Steel Casting Co., Milwaukee; C. E. Davis, Homestead Valve Mfg. Co., Coraopolis, Pa.; W. H. J. Cluff, president, Frederic B. Stevens, Inc., Detroit; Frank A. Sherwin, vice president and general manager, Dominion Foundries & Steel Ltd., Hamilton, Ont.

Election of officers will be held at the annual business meeting of the association during the convention in Toronto, Aug. 20 to 23.

A. S. T. M. To Show Work of Committees

In addition to interesting displays by leading companies in industry, the exhibit of testing apparatus and related equipment to be held during the 38th annual meeting of the American Society for Testing Materials in the Book-Cadillac, Detroit, June 24-28, will feature special instruments and apparatus as developed by the A.S.T.M. committees and various research laboratories.

Committee B-3 on corrosion of nonferrous metals and alloys will have an extensive display showing many corroded specimens which have been collected from various test racks throughout the company. The display will cover the committee's work on atmospheric, galvanic and electrolytic and liquid corrosion. Committee B-6 on die cast metals and alloys will show a number of specimens of various alloys, and a display of corrosion specimens which the committee has had under way. Work of the committee on metallography also will be shown.

Forms Committee On Alloy Cast Irons

A committee on alloy cast iron has been formed recently by the American Foundrymen's association with the following membership: Chairman, H. Bornstein, Deere & Co.; vice president, A. L. Boegehold, General Motors Corp. (also representing A. S. T. M.); secretary, Robert E. Kennedy, American Foundrymen's association; V. C. Mekeel, Mekeel Engineering Co. (representing Liberty Foundry Co.); R. F. Harrington, Hunt - Spiller Mfg. Corp.; H. B. Knowlton, International Harvester Co. (also representing A. S. M.); C. J. Tobin, General Motors Corp.; F. E. McCleary, Chrysler-Dodge Corp., (also representing S. A. E.); G. F. Comstock, Titanium Alloys Mfg. Co.; Charles Hardy, Charles Hardy, Inc.; H. P. Furlong, Molybdenum Corp. of America; E. K. Smith, Electro Metallurgical Co.; E. R. Young, Climax Molybdenum Co.; A. J. Herzig, Climax Molybdenum Co.; V. A. Crosby, Climax Molybdenum Co.; J. Strauss, Vanadium Corp. of America; H. Chandler, Vanadium Corp. of America; Mr. Dawe, Vanadium Corp. of America; Fred J. Walls, International Nickel Co.

The chief purpose of the committee is the preparation and publication of a symposium in which the data are limited to alloy cast irons.

Iowa Founders Discuss Cupola Melting

Don J. Reese, Whiting Corp., Chicago, addressed a meeting of the Northern Iowa Foundrymen's association on April 23 at Waterloo, Iowa, on "Melting Methods in the Foundry". Mr. Reese stressed the practical aspects of cupola operation and explained the difference between melting in a cupola and in an air furnace. He also discussed the proper method of operating the cupola.

Attendance of 125 included visitors from Marshalltown, Cedar Rapids, Cedar Falls, Iowa, and Rockford, Moline and Chicago, Ill.

BRACKELSBERG
Rotating Furnace

FOUR 8-TON FURNACES ON ONE ORDER

A manufacturer of automotive parts has just contracted for four 8-ton Brackelsberg units for melting special high-test metals. Before deciding upon the Brackelsberg they made a thorough survey of all other processes and were sufficiently impressed with the Brackelsberg record on malleable and gray iron to purchase four 8-ton units.

• ***Results Tell the Story*** "High-quality castings at low-cost operation" sums up the main advantage of the Brackelsberg to American foundries today. The demand for better castings is on the increase but low-cost operation is essential to profits. It is the ideal melting unit for high quality metal — fine, even-grained castings, in small or large tonnage. No other furnace so completely fills these requirements as the Brackelsberg.

Assuming average conditions, the use of a Brackelsberg for malleable iron (in 5-ton heats or larger) means a saving of approximately $4.00 per ton of iron melted, over stationary air furnace. Because of the many variable factors which enter into any metallurgical operation, the actual figures for each installation will be different, but the savings in all cases are substantial.

• ***Adaptable to Special Conditions*** The Brackelsberg is a very flexible melting unit. The same furnace may be used for a great variety of different mixtures. It is this adaptability to special conditions and requirements that makes it especially valuable in plants producing a variety of high-grade special castings.

• ***Absolute Control*** The ability to uniformly control the composition for any required product is an outstanding advantage of the Brackelsberg melting process.

• ***How the Brackelsberg Fits Into Your Business*** Of course your business is different. They are all different. But don't pass up this money-saving opportunity. It will cost nothing to get the facts. Let us show you how it will fit into your business and save you money. No obligation.

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WHITING

THIS IS OUR FIFTY-FIRST YEAR

Michigan State Features Gray Iron

Short course under joint sponsorship discusses recent metallurgical progress

UNUSUAL interest in numerous phases of the metallurgy of high test cast iron developed at the sectional foundry meeting held May 9, 10 and 11 at East Lansing, Mich., under the joint sponsorship of the American Foundrymen's association, the Detroit Foundrymen's association and Michigan State college. A number of interesting papers, presenting data on newer developments, brought out an exceptionally wide range of discussions at every session. Meetings were held in the R. E. Olds hall of engineering on the Michigan State campus. Attendance approximated 100.

At the opening session Thursday morning, W. H. Spencer, metallurgist, Sealed Power Corp., Muskegon, Mich., spoke on "Fundamental Aspects of Cast Iron". Sherwood Bennett, Capitol Castings Co., Lansing, Mich., presided. Mr. Spencer pointed out that a study of gray cast iron is complicated by the large number and comparatively large amounts of nonferrous materials present in the iron. He stated that in one case 43 elements were found in one pig of iron. Amount and distribution of various constituents, including mainly graphite, ferrite, cementite, and pearlite, determine the structure of the iron. The author then explained the structure of the constituents and stated that they tend to give physical properties to the cast iron in proportion to the volume which they occupy. Mr. Spencer completed his paper with a description of the microstructure of cast iron.

Copper in Gray Cast Iron

Effects of various elements on structure of cast iron featured the discussion. In reply to one question, the speaker stated that copper is added to cast iron to provide corrosion resisting properties for organic acids and atmospheric corrosion. If over 1 per cent of copper is added, often the excess copper segregates, especially when the metal is poured hot. Some other nonferrous metal, such as nickel must be added to permit more of the copper to be dissolved in the mass of iron.

A paper "Superheating Cast Iron" by F. G. Sefing and M. F. Surls, Michigan State college, East Lansing, was presented by Mr. Surls at the Thursday afternoon session, with Harry Rayner, foundry metallurgist, Dodge Bros. Inc., Detroit, as chairman. The first part of the paper reviewed briefly the work which has been done on superheating in various parts of this country and abroad. A second part was in the form of a progress report of a series of experiments on superheating which was carried on by the authors at Michigan State. The metal was melted in an indirect arc, rocking type, electric furnace. In a test in which all variables except temperature were held as nearly constant as possible, no marked results were accomplished by superheating. Tests then were made in which the iron not only was brought to superheat and bars poured, but one set of bars was poured from metal which had been held in the furnace at the superheating temperature for one-half hour. In each test, some increase in physical properties was found after holding at the superheated temperature. There was also a refinement of graphite with much of the fine graphite associated with ferrite.

The authors have drawn the following observations from the results explained in the progress report:

1—It was not found possible to obtain consistent improvement in properties by superheating alone. In this respect, it must be remembered that it was the aim of the investigators to vary nothing but the furnace temperature.

2—As the length of time the metal was held in the furnace at a higher temperature is increased more favorable results are obtained.

3—High superheat has a tendency to give a structure consisting of fine graphite and ferrite, and that tendency is more pronounced as the size of section decreases.

In discussing the subject, Prof. A. E. White, University of Michigan, Ann Arbor, spoke of the work along similar lines which has been undertaken at the university. He stated that the experiments conducted there indicate physical properties improved when heated above 2700 degrees Fahr., but started to fall off rapidly when the temperature exceeded 2950 degrees Fahr. He attributed that condition to distribution and size of graphite particles in the final product. Where the metal is superheated to an extremely high temperature, it is likely that these particles will be too large in the final iron. Mr. White also spoke of the remarkable progress which has been made by the foundry industry in recent years.

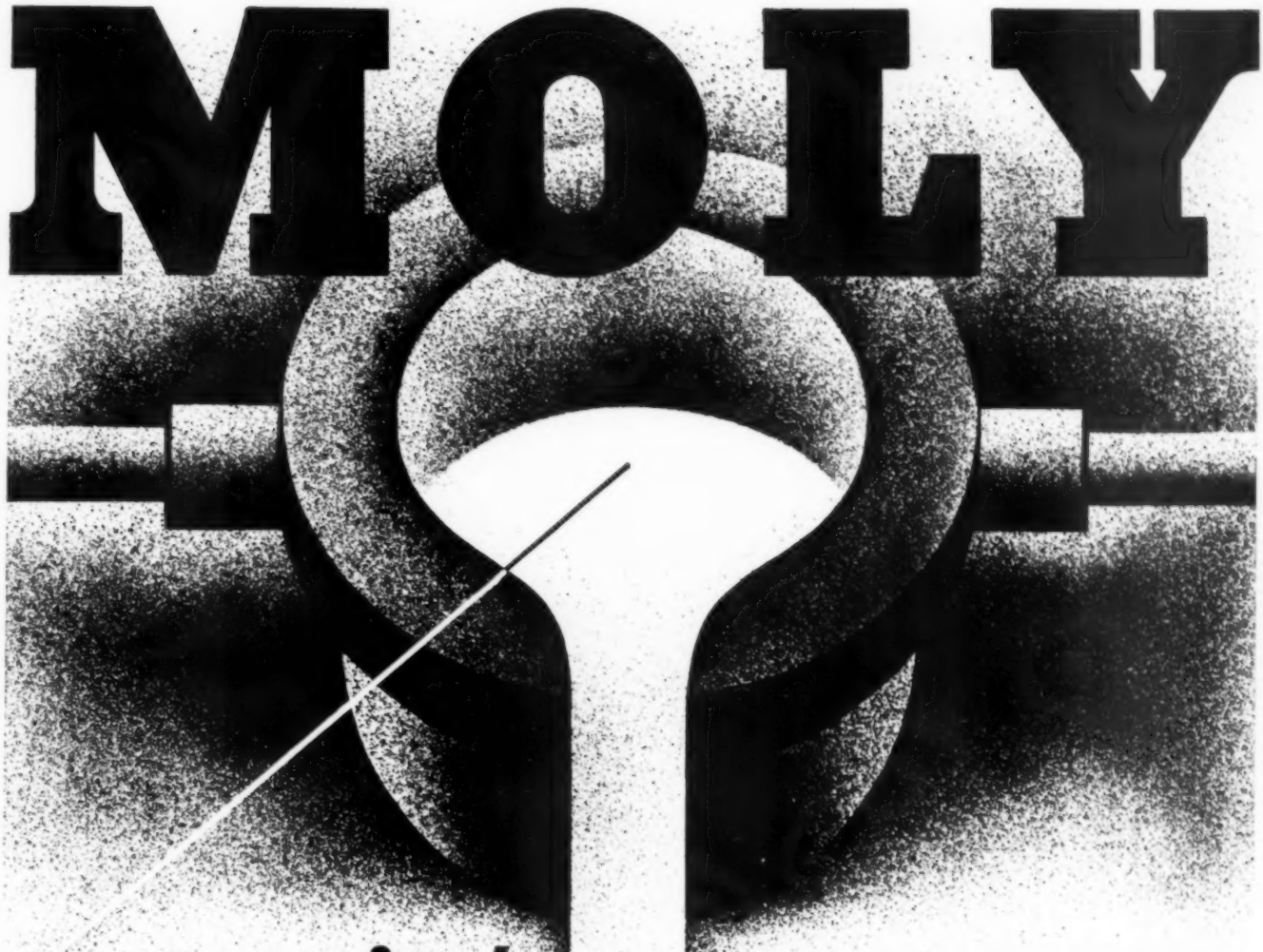
Profits in Using Alloys

The second paper, "Alloy Cast Iron", by E. K. Smith, Electro Metallurgical Co., Chicago, was devoted to the practical aspects of the subject. Mr. Smith pointed out that the use of alloys must be profitable to both the foundry and the ultimate consumer. In the foundry, use of alloys may be profitable by reducing the cost of the mixture, by reducing the scrap losses, and by increasing sales. The consumer may show a profit due to better machinability, increased life of certain types of castings thus lowering the maintenance cost, and a reduction in weight. In this connection, the author stated that more attention in the foundry is required for irons containing alloys and therefore the cost of a casting containing alloys is increased considerably above simply the cost of the alloy added.

Mr. Smith then discussed the various alloys which were added to gray iron to produce certain specific results, such as nickel, chromium, molybdenum, copper, titanium, etc. He pointed out that the practice of adding alloys in the ladle is increasing and stated that most alloys now are made in a special grade which dissolves easily in the ladle when used in the proper size.

Chill tests, in the speaker's opinion, add greatly to the ease of control of melting, since the test may be accomplished rapidly. Mr. Smith

(*Continued on page 44*)



. . . porosity's greatest enemy

THERE are times when whole batches of castings must be scrapped because of porosity. Many up-to-date foundrymen today look to Molybdenum to help them avert such loss-entailing crises. Doing so involves neither heavy added expense nor increased production difficulties. In fact, "Moly" usually saves its cost over and over.

The use of Moly requires no change in the mix — just add the small quantity prescribed by practice and the grain of the product becomes refined. And, instead of increasing machining difficulties, Moly actually diminishes them. Sounds too simple to be believable, doesn't it? Nevertheless, a comparative test will prove the claim as convincingly as was done in this actual instance:

A foundry, casting 12″-diameter pulleys into which a series of 2″ grooves was cut, found that, with a low enough carbon-and-silicon plain iron to eliminate porosity at the base of the grooves, shrinkage occurred in the center of the pulley. The problem was finally and simply solved by adding 1.00% Moly to the porous but non-shrinking iron — which eliminated both the porosity and the shrinkage.

Foundrymen interested in Molybdenum developments will find a great deal of practical information in our book "*Molybdenum in Cast Iron* — 1934 *Supplement*." A simple request brings it to you without charge or obligation. Upon request we will also gladly put you on the mailing list of our periodical news-sheet "*The Moly Matrix*." . . . And, if at any time you are confronted with some puzzling casting problem, you are quite welcome to consult our metallurgists or to use our Detroit experimental laboratories. Climax Molybdenum Company, 500 Fifth Avenue, New York. (In Canada: Railway & Power Engineering Corp., Ltd.)

CLIMAX Mo-lyb-den-um

(*Continued from page 42*)

then outlined the various physical characteristics which may be desired in gray iron, and indicated the alloys or combinations of alloys which assist materially in producing these characteristics. The latter part of this paper was devoted to the use of alloys in special intermediate types of white iron castings.

In reply to a question concerning the proper mixture for a chill used in the production of agricultural castings, the speaker stated that in his opinion chromium is needed to prevent growth and nickel to provide machinability. M. J. Leffler, Oliver Farm Equipment Co., South Bend, Ind., brought out the fact that the amount of alloy which may be added in the ladle, can be increased by preheating the alloy in a crucible before the addition is made. Preheating also may be used to secure better recovery with any amount of the alloy. The author stated that while he had found it possible to secure a penetration on the surface of a steel casting when chromium is coated on the molds, experiments with gray iron indicated that the chromium will run to one point and that the penetration is far from uniform.

Jesse D. Stoddard, Detroit Testing Laboratory, Detroit, presided over the evening session on Thursday, at which Dr. E. J. Martin, General Motors research laboratory, Detroit, presented an interesting discussion on the fundamentals of spectroscopy. Dr. Martin discussed the apparatus and methods used, and pointed to the possibilities of using the spectroscope for both qualitative and quantitative analyses. Qualitative analysis is accomplished through identification of the lines which show up in the spectrum of a certain element. Quantitative analysis is accomplished by the comparison of the intensities of lines, providing of course that the two spectrographs under consideration were made under similar conditions. Through the method of limits, it is possible to provide a close approximation of the analysis of a sample.

Good Laboratory Essential

W. R. Jennings, Ecorse Foundry Co., Ecorse, Mich., presented a paper "Practical Aspects of Founding High Test Cast Iron", at the Friday morning session, with Vaughan Reid, City Pattern Works, Detroit, presiding. Mr. Jennings stated that the first step in making high test irons is providing a good laboratory so that consistency in practice, the secret of success in the production of high test iron, may be obtained. The speaker stated that in his estimation, the value of the cupola as a melting medium has been utilized only to approximately 50 per cent of its possibilities. He recommended that in keeping the cupola operation consistent, attention be given the grade and size of coke used, since a good, dense coke with a total carbon of 90 per cent or better, is necessary. He also recommended the use of pig iron from two sources and stated that scrap free pig iron should be specified if it is desired to carry additional scrap in the cupola charge.

Tuyere height also is an important factor, according to Mr. Jennings, and the distance from the sand bottom to the tuyeres should be as shallow as possible, 8 to 12 inches in the average cupola being sufficient. He recommended the use of a fore hearth or receiving ladle to prevent the iron from remaining too long in contact with the coke. The speaker also discussed melting in the electric furnace, the powdered coal type rotary furnace, etc.

Many castings of a defective nature, blamed on the molding or sand, are due to defective gating and risering, in the opinion of Mr. Jennings. Gating of course should be governed by design of the casting and experience with the metal which is being poured. The author also pointed out it has been his experience that castings which show a wide brinell range from thin to heavy sections, are subject to casting strain, and will distort when one surface is removed by machining much more readily than a casting which has an evenness of microstructure as indicated by average brinell hardness. Castings are not particularly susceptible to cracks if shaken out hot, providing of course, the metal is heated to correct temperature before pouring and gated and risered properly.

In a prepared discussion of the paper, Harry W. Dietert, U. S. Radiator Corp., Detroit, stressed the need for the laboratory. He also pointed to the important physical tests usually conducted in the foundry, such as fluidity, chill, shrink, and strain. He also stressed the importance of proper slag control.

Many of the molding sands used in gray iron foundry work begin to fuse at a temperature as low as 1400 degrees Fahr., according to Mr. Dietert. A few sands will fuse upward to 1800 degrees. Therefore, it is not surprising to have considerable amounts of sand burned on castings which are poured with more elevated temperatures. In this connection, mold and core wash are employed to a large extent to improve the smoothness of the casting surface. It was also pointed out that a choke in the gate will clean the metal as effectively as a strainer core containing a large number of holes.

The question of slag control provided considerable interest in the discussion which followed, and several different views were advanced by Fred J. Walls, International Nickel Co., New York; Harry Dietert; Harry Rayner, Dodge Bros., Detroit; R. E. Aptekar, American Brake Shoe & Foundry Co., New York; V. A. Crosby, Climax Molybdenum Co., Detroit; Don J. Reese, Whiting Corp., Harvey, Ill.; Jesse D. Stoddard, Detroit Testing Laboratory, Detroit; H. Bornstein, Deere & Co., Moline, Ill., and Henry Lane, Detroit.

Friday afternoon was devoted to a paper "Heat Treating Cast Iron", by H. Bornstein, Deere & Co., Moline, Ill., with Glenn Coley, Detroit Edison Co., Detroit, as chairman. Mr. Bornstein pointed out the three general classifications of heat treatment, namely: 1—Annealing or normalizing, 2—Quenching and drawing, and 3—Special heat treatments.

Use Low Temperature Anneal

Low temperature annealing is employed to speed up the former process of aging, and to prevent distortion after machining. Temperatures range from 850 to 1000 degrees Fahr., and the time extends from 30 minutes to several hours, depending upon the casting. While annealing provides little change in strength and hardness, a loss of both properties results as the temperature is increased. Quenching and drawing is employed to obtain greater hardness and strength.

Composition is an important item, and the use of various alloy elements increases the response to heat treatment. The maximum temperature usually ranges from 1450 to 1600 degrees Fahr., and oil is used for quenching in a large percentage of cases. Under special heat treatments the speaker discussed nitriding, which is used to increase the wear resistance of the iron. Mr. Bornstein pointed out that tests are being conducted, on the sand casting of nitrided iron, a difficult procedure, due to the tenacious scum and viscous slag which is formed by the aluminum in the metal. Mr. Bornstein also discussed various types of malleable annealing equipment and stated that considerable work is being done in improving the annealing of malleable castings and cast products lying in the intermediate field between malleable cast iron and gray cast iron. In the discussion, Glenn Coley stated that some work is being done on heat treating castings inductively.

The Saturday morning session, presided over by Carl Harmon, superintendent, Chevrolet Motors Co., Saginaw, Mich., featured two papers, one "Engineering Properties of Cast Iron" by John W. Bolton, metallurgist, Lunkenheimer Co., Cincinnati, and the second, "The Foundry of 1950," by Fred J. Walls, International Nickel Co., New York. Mr. Bolton's discussion dealt chiefly with

(*Concluded on page 47*)

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(*Concluded from page* 44)

strength factors of gray cast iron and featured the results of a test which indicated the true elastic limits of cast iron. In a chart presented by Mr. Bolton, the ordinary stress strain diagram for the iron under test was shown. Another curve on the same chart indicated the permanent set at various loads, such as 25,000 pounds, 50,000 pounds, etc. That curve was obtained by taking a sample, loading it to 25,000 pounds and then unloading to determine the set. This was repeated with other bars at different loadings. The loading and unloading were repeated 25 times with each sample to determine the permanent set. A third curve then was constructed by subtraction of the permanent set from the total deformation. The curve thus constructed is indicated as a straight line. The true modulus of elasticity is about 15,000,000 pounds per square inch which is considerably higher than would be obtained by an evaluation of apparent modulus from the ordinary stress strain curve.

Ideal Foundry Prophesied

Speaking of the foundry of 1950, Mr. Walls prophesied that the foundry of the future will be completely air conditioned to eliminate dust and to equalize temperature. Lighting will be controlled automatically by a photo-electric cell. He pointed out that alloys will be much better understood and that waste will be cut to a minimum by rigid inspection of raw materials.

In conclusion, he stated that the foundry of 1950 would be an institution or industry wherein science will play an important part along with experience and that a continued effort of large research groups and colleges will be the beacons to guide the industry in gaining the present conception of the ideal foundry 15 years hence.

Speakers at the banquet on Friday night included Dan M. Avey, president of the American Foundrymen's association, and editor of THE FOUNDRY, H. B. Dirks, dean of engineering, Michigan State college, who welcomed the foundrymen to the campus, and Chester Culver, of Detroit. Brief remarks also were made by Frederick G. Sefing, Michigan State college; C. E. Hoyt, executive secretary, American Foundrymen's association, Chicago; Vaughan Reid, newly elected president of the Detroit Foundrymen's association; Hatsuo Dodo, vice president, Japanese Foundrymen's association; Harry Rayner, retiring president of the Detroit Foundrymen's association, and Robert E. Kennedy, technical secretary, American Foundrymen's association. Fred Erb, Eaton-Erb Co., Detroit and Vassar, Mich., and past president of the American Foundrymen's association was the toastmaster.

Pittsburgh Group Studies Casting Defects

A. M. Ondreyco, Meehanite Metal Corp., Pittsburgh, was elected president of the Pittsburgh Foundrymen's association for the group's coming year at its last monthly meeting held in the Fort Pitt hotel, Pittsburgh, Monday evening, May 20. W. H. White, Pittsburgh Rolls Corp., Pittsburgh, was elected vice president, and C. H. Paul, Mackintosh-Hemphill Co., Pittsburgh, was re-elected secretary and treasurer.

The executive committee elections likewise conformed to the nominations adopted at the monthly meeting in April, and the following are members of the executive committee for the coming fiscal year, beginning July 1, 1935: F. C. T. Daniels, Mackintosh - Hemphill Co., Pittsburgh; S. B. Cuthbert, Carnegie Steel Co., Pittsburgh; H. P. Spilker, Sterritt Thomas Foundry Co., Pittsburgh; C. E. Davis, Homestead Valve Mfg. Co., Coraopolis, Pa., and H. M. Wilson, Taylor-Wilson Mfg. Co., McKees Rocks, Pa.

The May meeting, attended by over 100, centered about the address of W. M. Ball, superintendent of foundry for the Edna Brass Mfg. Co., Cincinnati, who spoke on "Engineering and Its Relation to Defective Castings". Mr. Ball presented a short paper on this subject, after which a round table forum applying to not only nonferrous practice but also to steel and gray iron, was conducted.

Members of the Pittsburgh Foundrymen's association were especially interested in Mr. Ball's type of work in the so-called "Industrial Forum Courses" sponsored by the University of Cincinnati.

The May meeting concluded the formal monthly sessions of Pittsburgh Foundrymen's association until the fall of 1935, although the group will hold its annual outing and golf tournament Monday, June 17, at the Alcoma Country club, near Pittsburgh.

Northeastern Ohio Chapter Studies Budgets

The third meeting of the recently organized Northeastern Ohio Chapter of the American Foundrymen's association was held in the Cleveland club, Cleveland, May 16, with 90 present. Walton L. Woody, National Malleable & Steel Castings Co., Cleveland, and chairman of the chapter, presided.

Several present and past officers of the A.F.A. were present, including Dan M. Avey, editor of THE FOUNDRY, and president of the association; Robert E. Kennedy, Chicago, technical secretary of the A.F.A.; and L. W. Olson, Ohio Brass Co., Mansfield, O. and B. D. Fuller, Cleveland, past presidents of the national group. Mr. Kennedy spoke briefly on the possibilities of increased services to the foundry industry through local chapters now being formed, and Mr. Avey extended an invitation for the foundrymen in the district to attend the annual convention in Toronto, Aug. 20-23.

J. D. Goldie, foundry instructor, Cleveland Trade School, Cleveland, presented an interesting talk outlining the work of that school, which is a part of the public school system, in training boys between the ages of 16 and 19 in the fundamentals of foundry practice. Mr. Goldie explained the course of study now being followed and described the methods of teaching in the school foundry, which was equipped six years ago by a committee of foundrymen from the city.

S. C. Black, works manager, Willys Overland Co., Toledo, O., presented a thought provoking discussion of the methods followed by his organization in budgeting every department, with the idea of reducing waste and thereby reducing the overhead costs. A lively discussion followed the talk.

The chairman announced that the next meeting of the chapter will be held in the Cleveland Club, Thursday Sept. 19.

Treats Waste To Avoid Stream Polution

Chevrolet Motor Co., Flint, Mich., has demonstrated that the killing of fish by poisonous waste material discharged into streams by industrial plants can be prevented through treatment of the waste. The system used by that company is to accumulate the poisonous waste and treat it to remove the cyanide. The remaining liquid then is discharged slowly into the river. The treatment in the storage tank reduces the cyanide content in the undiluted solution to less than 1 part in 1,000,000. When that weak solution is allowed to mix gradually with the large volume in the river it self, the waste immediately is diluted to complete harmlessness.

Bulletin Covers Results of Researches

Recent bulletins of the engineering experiment station, University of Illinois, Urbana, Ill., include "Determination of Mean Statistics at High Temperatures of Some Commercial Gases," by Cullen W. Parmelee and Alfred E. Badger; and "The Creep and fracture of Lead and Lead Alloys," an investigation conducted under auspices of the engineering experiment station and the Utilities Research commission by Herbert F. Moore, Bernard B. Betty, and Curtis W. Dollinn.

Roll Call Shows Slight Change

Tabulation of foundries in the U. S. and Canada indicates depression effects on casting shops

THE foundry industry has counted off and closed ranks following the depression. This fact clearly is indicated by a summary tabulation based upon *Penton's Foundry List*, published June 1, 1935. This constitutes the first roll call of the industry since the summer of 1930, and the devastating effects of past business conditions are too well known to require retelling.

Result Is Encouraging

However, the showing as indicated by this count is surprising. It is distinctly encouraging to those familiar with the industry and the blows which it withstood during the past 5 years. While there has been a decrease in the number of foundries and the decline is evident in every branch of the industry, the loss in totals is less than might have been expected and reports of reopening idle establishments and new construction testify to the recuperative power of this basic industry.

No important or sweeping changes are indicated by this roll call. The decline in numbers varies but in slight degree as between different classes of castings manufacture. No geographical shifts nor extraordinary changes are apparent to indicate the movement of the industry away from certain areas or states. Even the ranking order of states and cities show few changes among the leaders.

The country wide nature of business stagnation is no better shown than by the fact that 14 states show an increase in the number of foundries, 29 a decrease and 9 show no change whatever in a tabulation which includes the 48 states, the Canal Zone, Philippine Islands and District of Columbia. Similarly in Canada one province showed an increase, 5 a decrease and 4 no change. As will be noted from Table I, the total number of foundries in the United States decreased from 5424 to 5080 in the past 5 years. This decline of 345 shops marks a loss of only 6.4 per cent in the total number of foundry establishments. In Canada the total number decreased from 494 to 470, a drop of 24 shops or 4.85 per cent.

Total Gray Iron Shops

The total number of foundries melting gray iron in the United States in 1930 was 3573, while this year shows 3215, a difference of 358 or 10 per cent. In Canada, 1930 showed 397 gray iron foundries, 1935 indicates 365, a difference of 32 or 8.1

(*Continued on page* 50)

Distribution of foundries in the United States and Canada

SHAKE-OUT DUST PROBLEMS *are solved by the* AIR CURTAIN SYSTEM *equipped with* ROTO-CLONE

This revolutionary development, perfected and patented by experienced foundry engineers, provides a means for confining dust at the shake-out without the necessity for hoods or enclosures. The shake-out grate remains freely accessible to the operator, both for placing the molds onto the shake-out and removal of the flask and castings.

A ROTO-CLONE Dynamic Precipitator serves to exhaust the air, together with dust, gases, and fumes, and precipitates the dust and free moisture. The required amount of supply air which forms the Air Curtain, may be recirculated from the Roto-Clone discharge or may be taken from the outside by means of a small independent blower, thus aiding in cooling the operator.

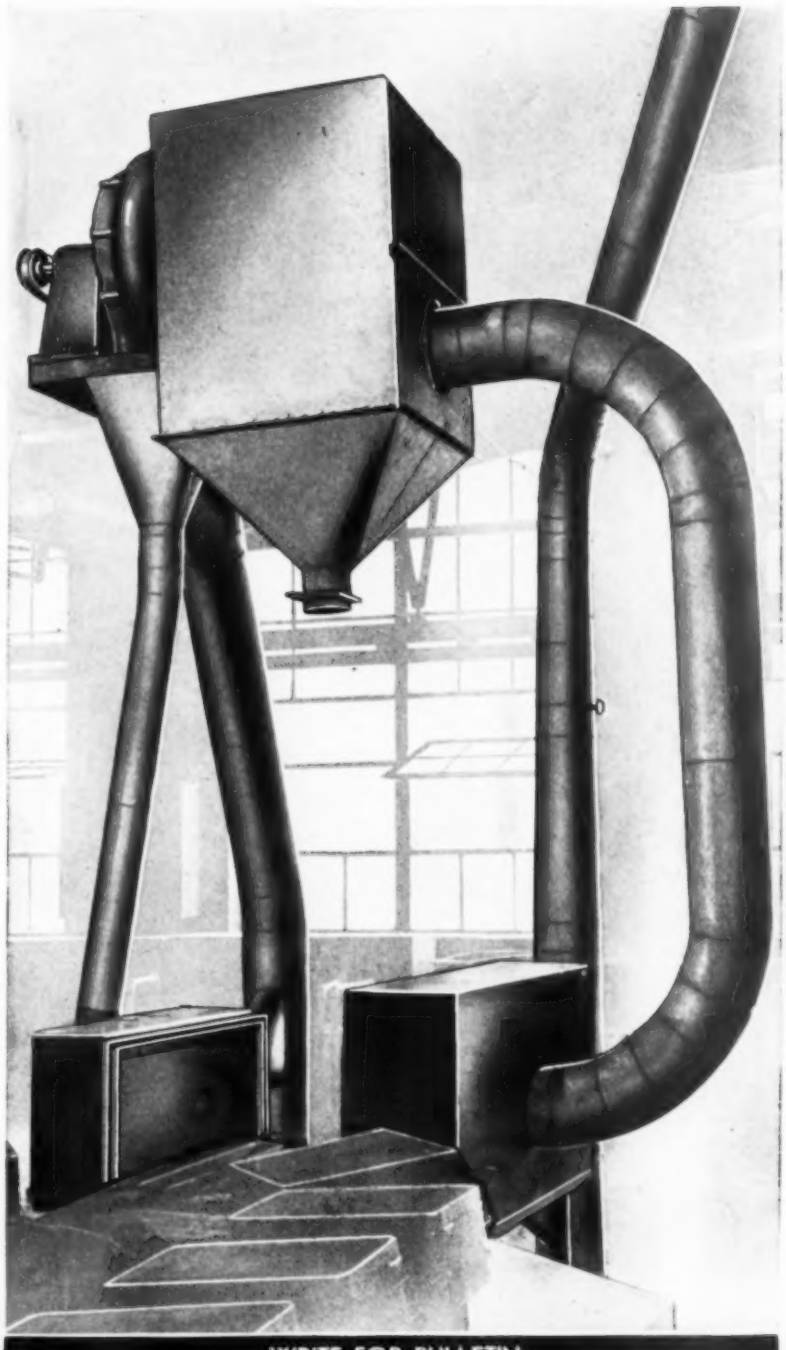
The outstanding advantages of the Air Curtain Dust Control System equipped with the Roto-Clone are:

1. **It offers a positive means of eliminating the dust nuisance from shake-outs previously difficult or impossible to control.**

2. **The air volume required is kept to a minimum with consequent saving in power.**

3. **Only a small amount of material, both coarse sand and bonding clay, is removed by the air, thus saving in dust collecting equipment and cost of rehandling material.**

ROTO-CLONE offers many outstanding features in the handling of other foundry problems such as the control of dust resulting from sand handling, core busting, core grinding, snag grinding, tumbling, and cleaning operations. Write for complete information.



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WRITE FOR BULLETIN
"FOUNDRY DUST PROBLEMS"

AMERICAN AIR FILTER CO., 70 Central Ave., Louisville, Ky.
In Canada—Darling Brothers, Limited—Montreal, P. Q.
Please send me a copy of Bulletin "Foundry Dust Problems."

Name _____

Street No. _____

City _____ State _____

(*Continued from page* 48)

per cent.

While a greater decrease in the total number of foundries melting nonferrous metals is shown, this probably is due in some measure to the discontinuing of small nonferrous departments of castings plants which melt other types of metal. The totals for 1930 and 1935 of those establishments melting nonferrous metals are 3044 and 2474 respectively showing a loss of 470 or 15.6 per cent. In Canada the respective totals are 297 and 286, the loss 11 or only 3.7 per cent. Meantime, only a small decline is noted in the total number of foundries melting aluminum. The total for 1930 was 2276, in 1931, 2163, giving a difference of 113 or 5 per cent. In Canada the total number of shops melting aluminum increased from 223 to 234 giving a gain of 8 or 3.6 per cent.

Malleable Iron Decrease

In the malleable industry the total number reported in *Penton's Foundry List* for 1930 was 166 and in 1935, 147 for the United States, showing a decline of 19 or 11.5 per cent. In Canada the totals were 16 and 12 respectively, a loss of 4 shops or 25 per cent.

Reports from steel foundries indicate that 319 foundries make steel castings in 1935, while 346 reported in 1930. This gives a difference of 27 or 7.8 per cent. In Canada the totals were 28 for 1930 and 24 for 1935, a decrease of 4 or 14.3 per cent. The tabulation of foundries in various states shows that Pennsylvania, Ohio, New York, Illinois and California maintain the same relative standing as the six leading foundry areas in point of numbers although each of the states in question shows a slight decline in numbers. Wisconsin has passed Massachusetts as seventh in the list, while Washington has advanced ahead of Tennessee into seventeenth place and

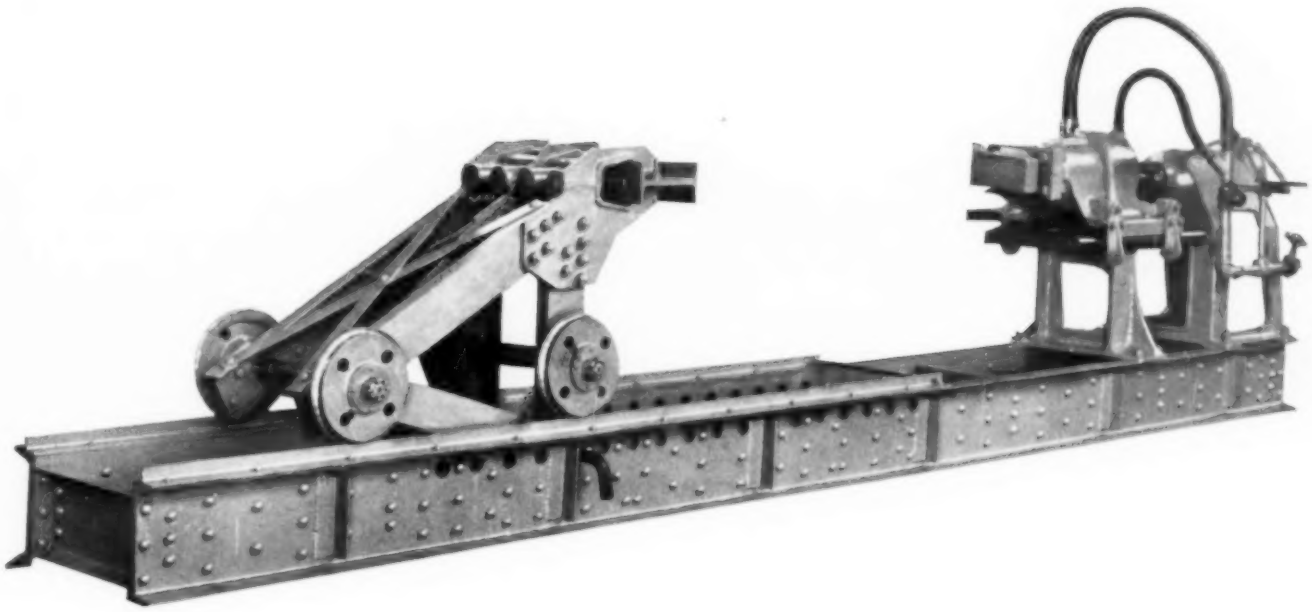
(*Continued on page* 52)

Table 1

Foundries of the United States & Canada—1935 and 1930

	Total Foundries 1935	Total Foundries 1930	Increase or Decrease in five Years	Gray Iron Foundries 1935	Gray Iron Foundries 1930	Exclusive Nonferrous Foundries 1935	Exclusive Nonferrous Foundries 1930	Nonferrous Foundries Dept. of Other Shops 1935	Nonferrous Foundries Dept. of Other Shops 1930	Total Nonferrous Foundries 1935	Total Nonferrous Foundries 1930	Malleable Iron Foundries 1935	Malleable Iron Foundries 1930	Total Steel Foundries 1935	Total Steel Foundries 1930	Electric Steel Foundries 1935	Electric Steel Foundries 1930	Foundries Melting Aluminum 1935	Foundries Melting Aluminum 1930	Permanent Mold Castings 1935	Die Castings 1935	Machine Shop 1935	Pattern Shop 1935
Alabama	98	98	..	82	87	8	8	22	29	30	37	1	1	5	6	2	3	20	23	2	..	64	68
Arizona	13	10	+3	9	10	..	..	8	8	8	8	..	1	2	2	2	2	4	6	..	..	5	9
Arkansas	17	16	+1	17	16	..	..	12	12	12	12	..	..	1	1	1	1	9	6	..	..	15	10
California	269	269	..	146	154	86	88	68	83	154	171	4	4	31	31	27	24	128	133	7	5	129	131
Canal Zone	1	1	..	1	1	..	..	1	1	1	1	..	..	1	1	1	..	1	1	..	..	1	1
Colorado	42	42	..	27	28	13	12	10	14	23	26	..	..	4	4	2	2	19	23	2	..	25	20
Connecticut	135	144	—9	58	68	54	58	32	34	86	92	12	12	6	6	5	6	70	67	4	4	79	81
Delaware	11	15	—4	5	7	3	4	5	5	8	9	1	1	2	2	1	..	5	4	..	..	9	8
Dist. of Col	7	8	—1	5	6	2	2	2	3	4	5	..	..	1	1	1	1	5	5	..	..	4	2
Florida	26	21	+5	21	18	4	3	19	15	23	18	..	..	2	1	1	1	24	17	..	..	20	21
Georgia	68	71	—3	56	65	3	4	16	44	19	48	..	..	2	2	1	1	27	34	..	..	43	46
Hawaii	3	2	+1	3	2	..	..	3	2	3	2	..	..	1	..	1	..	3	1	..	..	2	3
Idaho	7	8	—1	7	8	..	..	7	7	7	7	..	..	..	..	..	..	6	6	..	..	7	6
Illinois	392	425	—33	226	253	105	133	78	91	183	224	19	23	22	20	11	10	156	168	11	13	225	243
Indiana	220	234	—14	128	150	51	63	45	57	96	120	9	12	10	11	5	7	93	91	..	..	117	134
Iowa	86	94	—8	65	79	9	8	24	38	33	46	3	1	1	5	1	3	38	37	..	..	56	57
Kansas	48	44	+4	42	39	7	4	23	31	30	35	..	..	1	1	1	1	28	32	..	..	37	35
Kentucky	43	44	—1	31	32	12	11	11	14	23	25	..	..	..	..	..	..	14	18	..	..	27	22
Louisiana	31	34	—3	26	30	4	4	18	22	22	26	..	..	4	6	3	3	12	11	..	..	20	17
Maine	28	30	—2	26	26	2	3	20	21	22	24	..	..	1	1	..	..	19	22	..	..	19	22
Maryland	53	53	..	39	39	13	13	18	21	31	34	1	1	1	..	..	..	22	25	..	..	33	25
Massachusetts	225	247	—22	125	141	84	91	42	48	126	139	3	2	12	11	4	3	112	121	..	..	100	100
Michigan	327	355	—28	189	201	106	114	66	77	172	191	11	13	18	18	12	15	133	135	5	8	197	180
Minnesota	102	101	+1	73	73	24	22	30	36	54	58	1	1	4	6	3	3	39	45	2	1	63	55
Mississippi	18	20	—2	15	20	1	..	11	18	12	18	..	..	..	..	..	..	4	9	2	1	14	7
Missouri	109	124	—15	63	82	30	37	14	26	44	63	2	2	7	8	3	5	43	50	3	2	65	74
Montana	8	9	—1	8	9	..	..	7	9	7	9	..	..	..	..	..	..	2	5	1	..	8	7
Nebraska	28	28	..	21	20	4	7	12	14	16	21	..	..	1	1	1	1	18	19	1	..	19	18
Nevada	6	5	+1	5	4	1	1	5	4	6	5	..	..	2	2	2	2	5	4	..	..	6	5
New Hampshire	31	32	—1	19	23	9	8	10	12	19	20	1	1	2	1	1	1	15	16	..	..	13	11
New Jersey	194	217	—23	96	134	68	69	27	40	95	109	3	4	5	8	3	3	79	88	..	1	93	96
New Mexico	1	1	..	1	1	..	..	1	1	1	1	..	..	..	..	..	..	1	1	..	..	1	1
New York	432	479	—47	255	302	132	141	101	149	233	290	13	17	16	15	11	8	185	212	6	10	254	249
North Carolina	57	64	—7	54	62	3	2	38	48	41	50	..	..	..	..	..	..	34	40	..	1	37	37
North Dakota	4	3	+1	3	2	1	1	1	1	2	2	..	..	..	..	..	..	1	1	..	..	4	4
Ohio	555	595	—40	400	337	157	190	69	96	226	286	23	26	31	36	26	23	207	206	19	19	322	316
Oklahoma	36	34	+2	28	27	7	5	14	16	21	21	..	..	1	1	1	1	21	20	..	..	24	26
Oregon	46	48	—2	35	40	8	5	18	26	26	31	..	..	2	4	2	4	23	26	..	1	26	23
Pennsylvania	610	684	—74	401	459	137	145	156	186	293	331	19	22	67	78	30	32	221	224	4	12	431	419
Philippine Islands	3	1	+2	3	1	..	..	1	1	1	1	..	..	1	..	1	..	3	1	..	..	2	2
Rhode Island	36	43	—7	15	21	18	21	8	10	26	31	1	1	..	..	..	..	21	27	..	..	15	15
South Carolina	23	19	+4	23	19	..	1	16	15	16	16	1	..	2	1	..	..	13	11	..	..	14	13
South Dakota	3	6	—3	3	5	..	..	2	4	2	4	..	..	..	..	..	..	2	4	..	..	3	3
Tennessee	74	78	—4	61	67	9	9	27	32	36	41	1	2	1	2	1	1	26	26	3	1	49	52
Texas	83	86	—3	60	66	16	16	31	40	47	56	..	..	6	8	5	6	40	42	1	..	57	58
Utah	20	24	—4	17	20	3	2	10	11	13	13	..	..	2	5	1	4	11	10	..	..	10	11
Vermont	22	22	..	19	20	3	2	11	11	14	13	..	..	..	..	..	..	7	8	..	..	14	15
Virginia	72	69	+3	69	64	3	4	37	40	40	44	1	1	4	4	3	3	37	36	1	1	43	42
Washington	78	77	+1	56	54	15	16	36	36	51	52	..	..	15	15	14	13	39	38	..	..	37	45
West Virginia	49	47	+2	38	34	9	10	22	21	31	31	1	2	4	3	3	2	18	20	1	1	34	37
Wisconsin	227	241	—14	130	144	53	70	29	54	82	124	16	16	16	18	14	16	97	98	2	4	132	131
Wyoming	3	3	..	3	3	..	..	3	3	3	3	..	..	..	..	..	..	3	3	..	..	2	3
Total	5,080	5,425	—345	3,215	3,573	1,277	1,407	1,297	1,637	2,574	3,044	147	166	319	346	207	211	2,163	2,276	77	85	3,026	3,016
Alberta	13	15	—2	12	13	1	2	11	11	12	13	1	1	2	2	2	2	9	12	1	1	11	11
British Columbia	42	41	+1	33	34	8	6	23	24	31	30	..	..	4	4	4	4	26	24	1	..	25	30
Manitoba	13	13	..	9	11	3	1	2	3	5	4	..	..	2	2	2	2	5	4	1	..	11	10
New Brunswick	13	13	..	12	12	1	..	8	8	9	8	..	..	..	..	..	..	6	5	..	..	10	10
Newfoundland	3	3	..	3	3	..	..	3	2	3	2	..	..	..	..	..	..	3	1	..	..	3	3
Nova Scotia	22	23	—1	20	21	1	1	17	16	18	17	..	1	2	3	1	1	9	13	1	..	17	18
Ontario	263	279	—16	200	219	49	49	95	104	144	153	10	12	5	8	3	3	115	104	3	4	193	176
P. E. I.	3	3	..	3	3	..	..	2	2	2	2	..	..	..	..	..	..	..	1	..	..	3	2
Quebec	95	99	—4	70	76	15	13	41	50	56	63	1	2	9	9	8	7	55	54	3	2	74	75
Saskatchewan	3	5	—2	3	5	1	..	5	5	5	5	..	..	..	..	..	..	3	5	..	..	4	5
Total	470	494	—24	365	397	79	72	207	225	286	297	12	16	24	28	20	19	231	223	9	7	351	340
Total in U. S. and Canada	5,550	5,919	—369	3,580	3,970	1,356	1,479	1,504	1,862	2,860	3,341	159	182	343	374	227	230	2,394	2,499	86	92	3,388	3,356

Stoney Knockout Machines



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(*Concluded from page 50*)

Virginia has supplanted Georgia as nineteenth. The states of Minnesota, Washington, Virginia, West Virginia, Kansas, Florida, South Carolina, Arkansas, and Arizona show an increase of one or two foundries within their state boundaries.

Chicago again ranks first in the country in the total number of foundries with Cleveland going ahead of New York and Boroughs as the second foundry center. Los Angeles has moved from sixth place to fourth supplanting Detroit, while Milwaukee and Philadelphia both rank ahead of Boston. This year 60 cities are listed which have 13 or more, while 36 have more than 20 and 11 more than 50 shops.

Table II

Iron and Steel Shops 1935—1930

Total Foundries in the United States and Canada, 1935-1930

United States and Canada, 1935	5550
United States and Canada, 1930	5919
Total loss of foundries	369
Foundries, United States, 1935	5080
Foundries, United States, 1930	5425
Loss in United States	345
Foundries in Canada, 1935	470
Foundries, in Canada, 1930	494
Loss in Canada	24

Gray Iron Foundries in the United States and Canada, 1935-1930

United States and Canada, 1935	3580
United States and Canada, 1930	3970
Total gray iron decrease	390
Gray iron, United States, 1935	3215
Gray iron, United States, 1930	3573
Loss in United States	358
Gray iron, Canada, 1935	365
Gray iron, Canada, 1930	397
Loss in Canada	32

Malleable Foundries in the United States and Canada, 1935-1930

United States and Canada, 1935	159
United States and Canada, 1930	182
Total malleable decrease	23
United States, 1935	147
United States, 1930	166
Loss in United States	19
Canada, 1935	12
Canada, 1930	16
Loss in Canada	4

Steel Foundries in the United States and Canada, 1935-1930

United States and Canada, 1935	343
United States and Canada, 1930	374
Decrease	31
United States, 1935	319
United States, 1930	346
Decrease	27
Canada, 1935	24
Canada, 1930	28
Decrease	4

Electric Steel Foundries in the United States and Canada, 1935-1930

United States and Canada, 1935	227
United States and Canada, 1930	230
Decrease	3
United States, 1935	207
United States, 1930	211
Decrease	4
Canada, 1935	20
Canada, 1930	19
Gain	1

Form A. F. A. Chapter In Philadelphia

The Philadelphia Foundrymen's association, the oldest local group of foundrymen in America devoted to the study of practical and technical procedure, decided at a meeting held at the Engineers' club in that city, May 8, to affiliate as the Philadelphia Metropolitan chapter of the American Foundrymen's association. A committee was appointed to present nominees for a board and officers to report at the meeting to be held June 12. C. Walter Yost, Reading Iron Co. and president of the Philadelphia association presided at the dinner meeting where this action was taken.

R. F. Harrington, metallurgist, Hunt-Spiller Mfg. Corp., South Boston, presented an interesting paper on the modern developments in gray iron. He mentioned some of the older types of high test cast iron such as that used in the manufacture of cannon, which were remarkable for their attainment of high properties later made attainable through research. Dan M. Avey, THE FOUNDRY, president of the American Foundrymen's association, spoke on the work and aims of the organization in attempting the wider distribution of technical information. B. H. Johnson, R. D. Wood & Co., Philadelphia, vice president of the A. F. A. outlined the detailed procedure of affiliation of local chapters of the association.

Chicago Chapter Features Equipment

Chicago chapter, American Foundrymen's association, devoted the program of its monthly meeting May 2 to a discussion of various types of foundry equipment. About 80 attended. Eleven representatives of foundry equipment manufacturers gave brief talks on latest developments in their products, general discussion following these presentations.

Speakers and their topics included: G. C. Bush, department manager, American Foundry Equipment Co., Mishawaka, Ind., on "Tubular Air Filter"; W. E. Naylor, chief engineer, Beardsley & Piper Co., Chicago, on "Mold Shakeout"; Don A. Weber, general manager, Deister Concentrator Co., Fort Wayne, Ind., on "Foundry Spray Nozzles"; Harry W. Dietert, president, Harry W. Dietert Co., Detroit, on "Improvements in Sand Testing;" W. K. Knappe, secretary, Modern Equipment Co., Port Washington, Wis., on "Insulated and Covered Ladles."

L. B. Knight, sales manager, National Engineering Co., Chicago, on "A New Simpson Intensive Sand Mixer"; A. G. Rapp, representative, Royer Foundry & Machine Co., Wilkes-Barre, Pa., on "Scrap Remover and Sand Blender"; P. J. Potter, vice president, Pangborn Corp., Hagerstown, Md., on "Pangborn - Norbide Nozzles" and "Centrifugal Blasting"; R. E. Young, Whiting Corp., Harvey, Ill., on "Application of Stokers to Core and Mold Drying Ovens"; Elmer A. Rich, vice president, American Foundry Equipment Co., Mishawaka, Ind., on "Wheelabrator"; and Robert S. Hammond, Whiting Corp., Harvey, Ill., on

(*Concluded on page 55*)

Table III

Nonferrous Plants 1935—1930

Total Exclusive Nonferrous Foundries and Brass Departments of Other Plants in the United States and Canada, 1935-1930

United States and Canada, 1935	2860
United States and Canada, 1930	3341
Decrease	481
United States, 1935	2574
United States, 1930	3044
Decrease	470
Canada, 1935	286
Canada, 1930	297
Decrease	11

Exclusive Nonferrous Foundries in the United States and Canada, 1935-1930

United States and Canada, 1935	1356
United States and Canada, 1930	1479
Decrease	123
United States, 1935	1277
United States, 1930	1407
Decrease	130
Canada, 1935	79
Canada, 1930	72
Increase	7

Nonferrous Departments of Gray Iron, Malleable and Steel Foundries in the United States and Canada, 1935-1930

United States and Canada, 1935	1504
United States and Canada, 1930	1862
Decrease	358
United States, 1935	1297
United States, 1930	1637
Decrease	340
Canada, 1935	207
Canada, 1930	225
Decrease	18

Foundries Melting Aluminum in the United States and Canada, 1935-1930

United States and Canada, 1935	2394
United States and Canada, 1930	2499
Decrease	105
United States, 1935	2163
United States, 1930	2276
Decrease	113
Canada, 1935	231
Canada, 1930	223
Gain	8

ADVERTISING PAGES REMOVED

(*Concluded from page* 52)

"Brackelsburg Furnace."

The following officers have been nominated for election at the June meeting to serve during the following year: Chairman, James Thomson, Continental Roll & Steel Foundry Co., East Chicago, Ind.; vice chairman, L. J. Wise, Chicago Malleable Castings Co.; secretary, W. C. Packard, National Engineering Co.; treasurer, C. C. Kawin, C. C. Kawin Co. Mr. Thomson has served during the past year as vice chairman of the Chicago section.

Map Shows Location Of Refractories Plants

A map of refractories plants in the United States, based on a list of establishments compiled by the American Refractories Institute, has been published by J. H. H. Muirhead, 239 West 108 street, New York. The map incorporates a key listing of all refractories plants. Cities, towns, and villages having plants are placed to show the location and extent of the industry at a glance. So many plants are located in Ohio, Pennsylvania, and New Jersey, that a large scale map of the territory from New York to Chicago is inserted.

Book Review

Physical Chemistry of Steel Making, by C. H. Herty Jr., and Associates, fabrikoid, 340 pages, 6 x 9 inches, published by Carnegie Institute of Technology, and Mining and Metallurgical Advisory Boards, Pittsburgh and supplied by THE FOUNDRY, Cleveland, for $3 plus 15 cents postage, and in London by the Penton Publishing Co. Ltd., 416-17 Caxton House, Westminster.

This book is a collection of six bulletins issued at various times during 1934 by the Mining and Metallurgical Advisory boards, giving the results of investigations being conducted on the physical chemistry of steel making. The first bulletin is entitled, "The Effect of Deoxidation on the rate of Ferrite Formation in Plain Carbon Steels," by Herty, Lightner and McBride, and describes the method developed for determining the specific reactivity of any steel during ferrite formation in coarse and fine-grain steels. The second is entitled, "The Effect of Deoxidation on Grain Size and Grain Growth in Plain Carbon Steels," by Herty, McBride and Hough. The third bulletin entitled, "The Effect of Deoxidation on the Aging of Mild Steels," by Herty and Daniloff, shows that susceptibility of normalized rimmed steels to quench aging is high; the maximum being reached in steels containing 0.04 to 0.05 per cent carbon; steels killed with aluminum quench very little; that carbon and oxygen are factors in determining the aging properties of steel, etc.

The fourth bulletin is on "Effect of Deoxidation on the Impact Strength of Carbon Steels at Low Temperatures," by Herty and McBride. Among other conclusions drawn, the authors state that low temperature impact strength of mild carbon steels increases with decreasing oxygen content of the steel. The fifth bulletin is entitled, "The Control of Iron Oxide in the Basic Open Hearth Process," by Herty, Christofer, Freeman, and Sanderson, and describes methods for controlling oxide content. The sixth and concluding bulletin comprising the book is, "The Deoxidation of Steel," by Herty, describes reactions of deoxidation and gives the best values of various deoxidation constants. It also states that manganese-silicon alloys with a ratio of manganese to silicon of 4 or 5 to 1 are best for elimination of inclusions.

Table IV

Roll Call by Foundries by States, 1935—1930

Standing	State	1935	1930	Standing	State	1935	1930
1	Pennsylvania	610	684	27	Colorado	42	42
2	Ohio	555	595	28	Oklahoma	36	34
3	New York	432	479	29	Rhode Island	36	43
4	Illinois	392	425	30	Louisiana	31	34
5	Michigan	327	355	31	New Hampshire	31	32
6	California	269	269	32	Maine	28	30
7	Wisconsin	227	241	33	Nebraska	28	28
8	Massachusetts	225	247	34	Florida	26	21
9	Indiana	220	234	35	South Carolina	23	19
10	New Jersey	194	217	36	Vermont	22	22
11	Connecticut	135	144	37	Utah	20	24
12	Missouri	109	124	38	Arkansas	17	16
13	Minnesota	102	101	39	Mississippi	18	20
14	Alabama	98	98	40	Arizona	13	10
15	Iowa	86	94	41	Delaware	11	15
16	Texas	83	86	42	Montana	8	9
17	Washington	78	77	43	Idaho	7	8
18	Tennessee	74	78	44	District of Columbia	7	8
19	Virginia	72	69	45	Nevada	6	5
20	Georgia	68	71	46	North Dakota	4	3
21	North Carolina	57	64	47	South Dakota	3	6
22	Maryland	53	53	48	Wyoming	3	3
23	West Virginia	49	47	49	Hawaii	3	2
24	Kansas	48	44	50	Philippine Islands	3	1
25	Oregon	46	48	51	New Mexico	1	1
26	Kentucky	43	44	52	Canal Zone	1	1

Table V

Leading Foundry Cities of the United States and Canada, 1935—1930

Standing	City	Total Foundries 1935	1930	Standing	City	Total Foundries 1935	1930
1	Chicago	158	163	31	Chattanooga	25	25
2	Cleveland	116	113	32	Rochester, N. Y.	24	27
3	New York (Brooklyn and Boroughs)	101	112	33	Kansas City	24	25
4	Los Angeles	99	91	34	Springfield, O.	22	25
5	Detroit	93	94	35	Grand Rapids	21	23
6	Milwaukee and West Allis	85	86	36	Oakland, Calif.	21	23
7	Philadelphia	78	83	37	Bridgeport, Conn.	20	23
8	Boston (Greater Boston)	55	60	38	Worcester, Mass.	20	21
9	Cincinnati	53	56	39	Vancouver, B. C.	20	21
10	St. Louis	52	60	40	St. Paul, Minn.	20	19
11	Buffalo	50	48	41	Rockford, Ill.	18	20
12	Toronto, Ont.	47	49	42	Moline, Ill.	18	18
13	Pittsburgh	41	48	43	Atlanta, Ga.	18	18
14	Newark, N. J.	37	40	44	Racine, Wis.	18	16
15	Minneapolis	36	33	45	Canton, O.	16	17
16	Baltimore	35	33	46	New Haven, Conn.	15	15
17	Birmingham, Ala.	34	29	47	Houston, Tex.	15	14
18	Seattle	33	30	48	Elkhart, Ind.	15	14
19	Columbus, O.	32	32	49	Providence, R. I.	14	17
20	Dayton, O.	30	33	50	Anniston, Ala.	14	17
21	Montreal, Que.	29	33	51	Muskegon, Mich.	14	16
22	Erie, Pa.	30	34	52	Hamilton, Ont.	14	15
23	Indianapolis	29	33	53	Peoria, Ill.	14	14
24	Denver, Colo.	28	27	54	Saginaw, Mich.	14	14
25	San Francisco	27	35	55	Quincy, Ill.	13	16
26	Toledo, O.	27	31	56	Belleville, Ill.	13	15
27	Portland, Oreg.	27	28	57	Salt Lake City	13	15
28	Reading, Pa.	27	24	58	Jersey City, N. J.	13	14
29	Louisville, Ky.	26	27	59	Lancaster, Pa.	13	13
30	Syracuse, N. Y.	26	24	60	Richmond, Va.	13	11

Describes Alternative Methods for Drum Cores

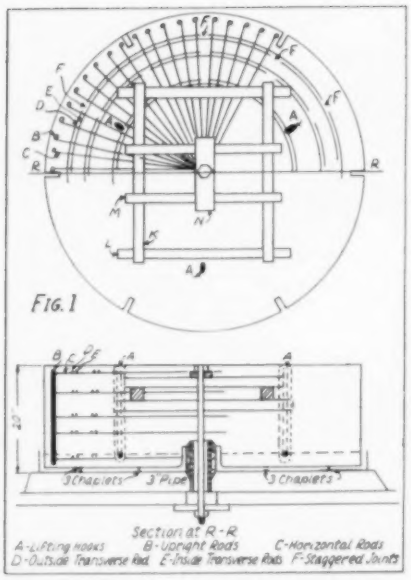

Fig 1—Plan and sectional view of core showing method or reinforcement

MAKING the mold for the drum casting shown in Fig. 3 presents no particular problem, whether made in green sand, dry sand or loam. If only one casting is required the mold could be made quite satisfactorily in a green sand or a skin dried mold either in the floor or in an iron flask.

Where a considerable number of castings are needed a dry sand or loam mold may be used repeatedly with a little minor patching here and there. Where a loam mold is employed the inside of a flask is bricked and a loam face swept on in the usual manner. With this method all the work incident to ramming sand around the mold in a pit or inside a curbing ring is eliminated.

In this particular case where the core sand and core irons must be removed through two 4½-inch holes, one in the top and one in the bottom, the problem of making the core presents some interesting features. If it was possible to place a big barrel or a good stiff arbor in the core the job would present no difficulty. However, that is out of the question because the barrel or the arbor could not be removed. Even a moderately stiff arbor could not be broken and removed readily. Practically the same objections hold with any proposal to use long pipes or bars bent in the form of rings.

Under existing conditions either stud or stem chaplets will be required top and bottom. Use of chaplets on the bottom might be eliminated by hanging the core from the cope, but since that method would entail more work on the core, it is scarcely worth the trouble. Also the bolt for suspending the core would interfere to some extent with the escape of the vent.

If the casting has to be water tight, or has to resist water, steam or air pressure, it probably will be necessary to drill the chaplets out and screw plugs in the holes. Where this condition obtains, the extra trouble of hanging the core from the cope might be justified since it will render a certain amount of machine work unnecessary.

Assuming that an absolutely tight joint around the chaplets is not necessary and that it is proposed to bolt the core to the bottom plate, the following method is submitted for consideration. The accompanying illustrations practically are self explanatory. Parenthetically it might be added, that while the upper chaplets probably would hold the core in place satisfactorily, the bolt in the bottom provides an extra factor of safety.

Since the drum has to balance, and therefore the metal thickness of the walls must be uniform, it is practically obligatory to provide a planed plate on which to build the core. If a considerable number of castings was ordered, a machined cast iron corebox, in two or a greater number of sections might be justified. However, for one or even for a dozen or more castings, a good, substantial wood corebox will serve satisfactorily. Made of properly seasoned lumber, strongly braced and well shellacked on the face, there is little tendency for the box to warp or twist. By scribing a ring on the plate the box may be checked for accuracy of dimension and shape each time it is used. If necessary, minor adjustments may be made with jack screws and wedges.

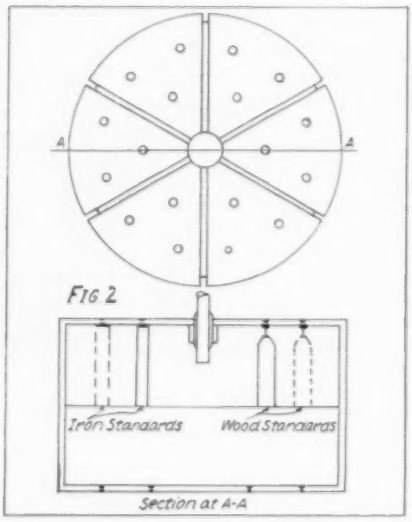

Fig. 2—Iron or wood standards are incorporated in the green sand upper half core

The core might be made all in one piece either by (a) leaving one set of ribs in the sand until after the dried core is removed from the oven, or (b) by making the core in an inverted position, removing the ribs from the exposed part, filling the spaces with black sand and then rolling the green core over on a plate. Rolling a core that size is an awkward job, requires a certain amount of time and should be avoided if possible.

A more satisfactory method is to make the core in halves, a top half and a bottom half, which of course are made in the same half corebox, that is a corebox half the height of the casting. If the box is made in the usual manner with a bottom to which the ribs are attached, the core destined for the bottom section is rolled over on a plate, dried and then rolled back to the proper position afterward. The core destined for the top or upper position may be rolled over on a plate rib side up. After it is dried it is picked up in that position and lowered into place on the bottom half.

The foregoing procedure and incidentally the cost of the corebox may be reduced to a considerable extent by providing a plain ring corebox, that is one without a bottom. Sand is rammed in this corebox almost to the top and then the upper ribs are placed in position. The corebox is removed from each of the two cores, and after they are dried, the core destined for the lower position in the mold is rolled over. The other core remains in the position it occupied during the construction and baking periods, and therefore in the proper position to be picked up and lowered into the mold.

Since the casting measures only 40 inches between the ends, it is apparent that none of the core irons can be much longer than 3 feet if they are to be removed readily. The sketch of the bottom half of the core, Fig. 1, shows a proposed method for getting around that difficulty. Assuming the easiest way is taken, that is the way to avoid rolling the bot-

(*Continued on page 58*)

One of the plants

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tom core over twice, the ring corebox is placed on the planed plate with the joint line of the core on the plate. The vertical ribs are in place, but the spider made up of the hub and horizontal ribs are left out until the box is rammed with sand almost to the top.

A layer of sand 2 inches thick is rammed over the plate. A row of 1-inch diameter rods or pipes, *B*, is erected about 2 inches from the face of the corebox. At first the upper end of each rod rests against the corebox, but they are straightened up with the next course of sand. Pieces of pipe or rods, *C*, approximately 3 feet in length, then are laid horizontally as shown in the sketch. Slightly curved rods, *D* and *E*, the same length then are laid over these rods transversely and with the circles 8 or 10 inches apart. Note that there are pairs of rods side by side in each ring, but that the breaks are staggered as in laying brick. This method of rodding the core is continued at each 5-inch course of sand.

Grid Is Built Up

The grid shown in the center is made up of 2-inch square billets, or alternately pieces of steel bars, or heavy 3-inch pipe in which none of the pieces is over 3 feet in length. It is built up gradually as the ramming progresses. The piece *N* may be a short length of flat bar steel ¾ or 1-inch thick, 4 inches wide and 18 inches in length with a hole in the center for a 1½-inch bolt. This plate is centered exactly and is raised about 2 inches from the coreplate to provide room for the head of the bolt later. The two bars *M* are placed in position followed by the bars *K* and *L*. The three lifting loops *A* then are set up equidistantly. A short piece of pipe or wood plug is erected in the center to form an opening for the holding down bolt later and then the corebox is filled with sand and rammed in the usual manner. The hub and ribs are adjusted in place and then removed after the sand has been scraped off flush with the top of the corebox.

Preferably the box should be in two parts with the vertical ribs loose so that the box may be removed without rapping. After this core is dried it is turned over and placed in the mold where it will appear, as in the lower part of Fig. 1, with three stud chaplets under each of the triangular divisions made by the ribs. A loam bottom will support the studs, but if the bottom is sand, suitable bearings will be necessary. A similar half core may be made for the top half, but without the bolt rigging.

However, a great deal of work may be saved by forming the top half in green sand. After the bottom half of the core is lowered into place in the mold the cheek is removed and the corebox is set above the lower core on suitable supports around the outside. Standards, which may be wood or iron are erected as shown in Fig. 2, three on each section of the core as defined by the ribs. The iron standards may be pieces of pipe with a small flat plate on the bottom and another on the top to come flush with the top of the core. If 4 x 6-inch, or larger wood standards are used they are tapered at the top and cut to come about 3 inches below the top of the core. An iron block, a piece of brick or a stud chaplet is placed on top to complete the necessary height. These blocks may be split readily with a long chisel bar for removal from the casting.

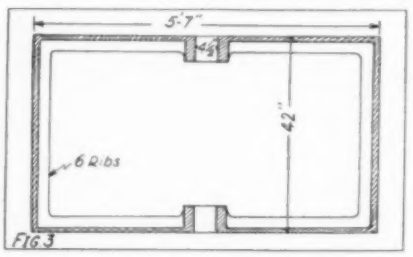


Fig. 3—Sectional view of drum casting

A layer of coke is spread over the face of the dry sand core and then the corebox is filled with green sand, rodded, rammed and scraped off flush. The usual precautions are observed. That is the sand is rammed gently on the top and the entire face is vented down to the coke bed. The vent from this part of the core escapes through a pipe which extends through the center of the hub core. The best method of gating this casting is through a ring of small pop gates ½ x 1½-inch on the rim and set slightly on a slant to prevent the metal from impinging on the green sand core.

Develops New Deoxidizer for Brass

A sodium-zinc alloy recently has been developed jointly by the Grasselli Chemical Co., and the "R & H" Chemical division of the Du Pont Co., for use as a deoxidizer in nonferrous practice. The alloy may be used for all nonferrous alloys where a content of 2 per cent or more of metallic zinc may be tolerated or is called for.

Constituents of the alloy are 98 per cent intermediate grade zinc and 2 per cent metallic sodium. It is cast in ingots which are semicylindrical and fitted with breaking notches for the sake of ready divisibility. The melting point of the alloy is about 140 degrees Cent., which is higher than pure zinc. Ingots may be stored without any particular precautions other than those which would be observed in the storing of slab zinc, for the alloy, despite its sodium content is not unstable, it is claimed.

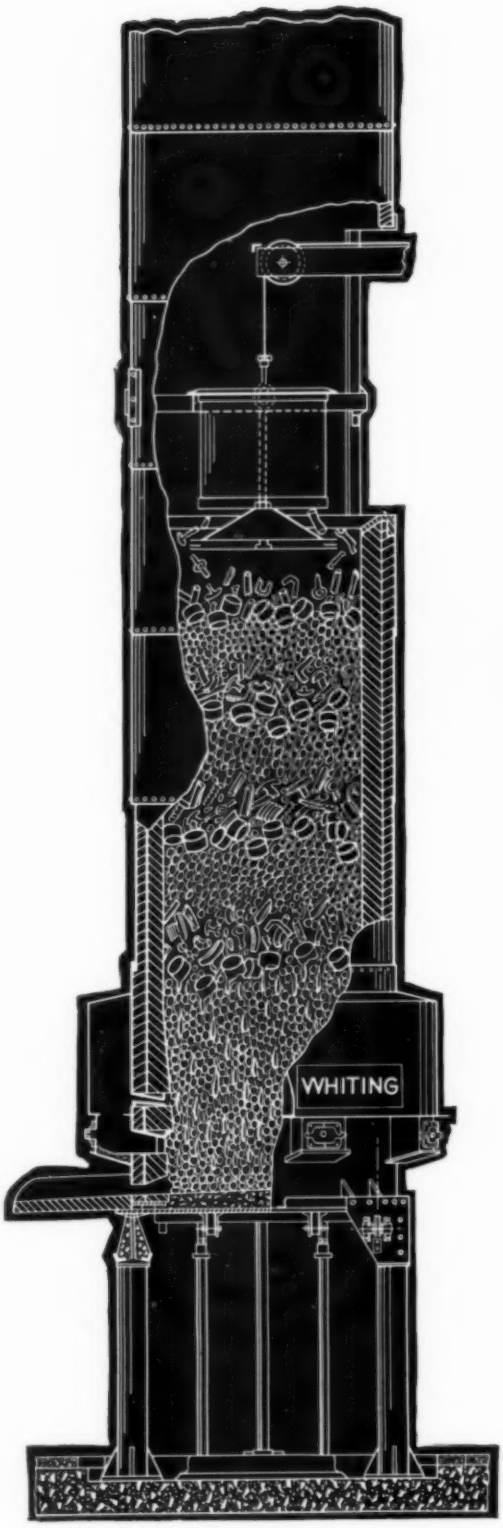
In using the deoxidizer, the mixture is made up with less than the final desired amount of zinc, to compensate for the additional zinc charge in the alloy. After the brass batch is ready to pour the requisite amount of sodium-zinc alloy is added in solid form. The fragments sink to the bottom of the bath, and at the high temperature encountered, the alloy breaks down into its components. The sodium, with a tremendous affinity for oxygen, reduces any metallic oxides that are present in the bath, regardless of state. The sole products of the reaction are sodium oxide and pure reduced copper, tin, zinc, or whatever metal is present in the bath before the addition of the deoxidizer. The sodium oxide, which has a normal boiling point of 880 degrees Cent., boils out of the bath with considerable vigor, resulting in bubbling or stirring action. This is claimed to be highly beneficial to the metal, reducing segregation and imparting a *liveness* which is noticeable even when the metal is poured into the mold.

Book Review

Sweep Molding in Sand and Loam (Die Schablonenformerei in Sand und Lehm), by A Geissel, paper, 6¼ x 9¼ inches, 137 pages, published by Wilhelm Knapp, Halle (Saale), Germany, and supplied by THE FOUNDRY, Cleveland and in London by the Penton Publishing Co. Ltd., 416-17 Caxton House, Westminster.

This volume, which is printed in German, is the twenty-first of a series on plant practice in iron, steel and metal foundries which is being edited by Hubert Hermanns. It is devoted to sweep molding in sand and loam, and is divided into three main sections. The first discusses the mold materials and sweeps or templets. The second describes cores and their production in general; sweep molding with detailed information on specific jobs such as pulleys, flywheels, grooved pulleys, reducers, etc.; loam molding with descriptions of making air receivers, kettles, hydraulic cylinders, propellers, etc.; core molding; permanent molding including examples of drying cylinders, or drums, sulphate pan, hydraulic piston, and kettles, and the concluding part of the section is devoted to a discussion of means for obtaining clean castings.

The third section or part of the book describes methods for obtaining dry molding pits, drying apparatus including portable and stationary appliances, and drying trucks.



Electromet Ferro-Alloys now available in briquet form include E. M. SILICON BRIQUETS (round) E. M. CHROMIUM BRIQUETS (hexagonal) E. M. MANGANESE BRIQUETS (square)

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27-G

Take Pride in Clean Plant

(*Continued from page* 21)

truck for transportation to the adjoining foundry building with ease and safety to the workmen. A card index of all flasks is maintained in the foundry, and a record is kept of each flask taken from the yard or returned to the storage after it has been used. Not only does that type of storage provide the features of safety and cleanliness but considerable time of the workmen is saved in locating the desired flasks and in moving them to the foundry. A flask storage for the sand spun pipe flasks, illustrating the orderly methods of storing and the ease with which any particular flask may be handled to and from the machine shop for reconditioning, is shown in Fig. 10.

Aisles Marked on Floor

The same type of order and cleanliness is maintained in the various buildings of the plant. In the machine shop, pattern shop, brass foundry, storehouse, etc., aisles are marked on the floor and nothing is allowed to remain in the aisles. The method of marking out the aisles is well illustrated in Fig. 8, a view of one end of the machine shop, with several flasks for the sand spun shop in the immediate foreground. Figs. 7 and 8 are exceptionally interesting, since they were taken from the same place in the machine shop, and show clearly the exceptional results which have been accomplished in the good housekeeping program. All of the disorder illustrated in Fig. 7, made prior to the start of the safety-good housekeeping program, now has been eliminated, and with this cleanup program has come greater safety for the workmen as well as greater efficiency in the operation of the department. The same method is followed in the pattern shop, where all patterns for fittings and machine castings are produced. White lines mark the aisles on the floor and here again, nothing is allowed to remain in the aisles. Benches and the various woodworking machines are set square with the aisles. Pattern lumber is stored on a balcony at one end of the building.

Gangways in the brass shop, which is devoted to production of brass and bronze hydrants and hydraulic valve parts, as well as certain aluminum castings needed by the plant, are indicated carefully. Molders clean up around the bench and floor, melters keep the floor around the furnaces cleaned, and grinders clean the gangways in whatever spare time they may have. As a matter of safety hooks on all the cranes or hoists are painted yellow so that they can be seen readily. In addition, a sign attached to the crane indicates the maximum load that can be handled with safety. A sign carrying the following warning is posted near the door of the brass shop:

"Men working on brass should be particularly careful to wash their hands before eating lunch and also before going home at night. Safeguard yourself against the possibility of brass poisoning."

Safety Committee.

An interesting suggestion made by one of the workmen has facilitated the segregation of various types of brass scrap, such as turnings and borings, received from the machine shop. The machine shops are provided with kegs for handling such scrap and these kegs are painted different colors, each color designating scrap of a particular analysis. Bins in the brass shop metal storage department are painted the different colors to correspond with the kegs. Thus workmen in the machine shop place scrap in a keg of a certain color and when the scrap reaches the brass foundry, the keg is dumped into the bin of the corresponding color. Thus, foundry melters know that the scrap in one particular bin is of a certain analysis. Not all of the scrap is re-used in the foundry, and this method of segregation permits the company to secure a better price for that which is sold. A sign over the scrap bins carries the following instructions:

"Dump no scrap or turnings in these bins without first notifying the foreman."

Record Posted Daily

A cast aluminum tablet is attached to the inside door of each department of the plant, and carries the following interesting statement bearing directly upon the safety program:

This shop has
worked days
without
A lost time accident
Best previous period days
Work safely—it pays!

The member of the safety committee from the shop sees that the blank places are filled in each morning with the numbers giving the record of the particular shop. For example, at the time the plant was visited by the writer, the brass shop had worked 1558 days without a lost time accident.

A splendid illustration of good housekeeping as practiced by the Florence Pipe Foundry & Machine Co. is provided in the pattern storage department, and especially in that building devoted to the storage of hydrants and fitting patterns. Approximately 25,000 patterns are stored in that one building. The exceptionally large number of patterns is due to the wide variety of styles demanded by customers. For example, it is estimated that a 4-inch hydrant will require approximately 500 patterns for a complete series, due to the length of the hydrants, differences in design of nozzles, etc.

All patterns are on racks which extend from the floor to the roof of the building. To enable the men working in the pattern storage department to obtain any pattern quickly, a walkway, 24 inches wide, has been built along the ends of the rack and extending between the racks. A railing has been built around the entire walk as a matter of protection to the attendant. Electric lights in the pattern storage are provided with automatic takeup reels so that a light may be carried to any part of the department if needed. All patterns are card indexed and may be located quickly.

The foreman of the sand spun department has a saying that only the things that are found in the shop at

(*Continued on page* 63)

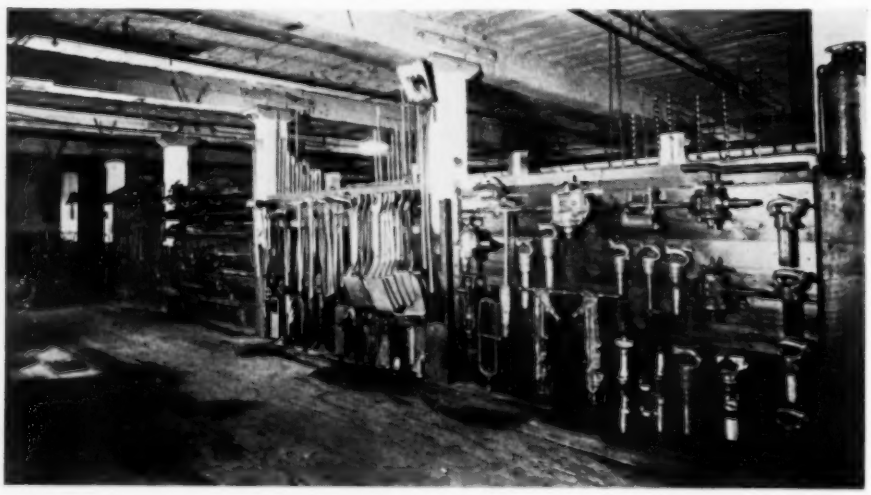

Fig. 11—Arrangement of equipment in the plant maintenance department

ADVERTISING PAGES REMOVED

(*Continued from page 60*)

any time are the things actually needed. Following this motto prevents the accumulation of materials in the shop, assists in keeping the aisles clear and at the same time saves money for the company by preventing waste. Workmen in this department know that if materials are found in the shop which are not needed, they will be asked to explain the reason for such materials being there. Wrenches and other tools needed in connection with the pipe spinning machines are locked in a large tool box every night, under the supervision of the foreman, and are taken out of the box only as needed.

The old saying regarding a place for everything and everything in its place, is well illustrated in many ways in the sand spun department. Extra ladles, or those needing repairs are not permitted in the foundry proper and are carried to one end of the shop where a special department has been set up for the repair and lining of ladles. Ladles are placed in a straight line in this department to provide greater work space around the ladle for the workman making repairs. Bins located near by hold the sand and brick used for that work. Another illustration of orderliness in the storage of working equipment is the rack for body patterns shown in Fig. 12.

Cleaning Is Automatic

As was the case in the other departments, previously described, each man in the sand spun department cleans around his own particular floor, bench or machine, as the case may be. This work seems to be accomplished continuously throughout the operating period. Whenever a man has any time between the various operations to which he is entrusted, such as in the sand spun plant where he assists in charging, casting and discharging the molds from the twisters, he cleans up around his particular section. Through the work of education carried on by the management, the urge to do this work seems to have become entirely automatic, therefore the plant always is clean.

The orderly arrangement in the sand spun plant and the cleanliness of the shop are illustrated in Figs. 1 to 4. The equipment used to remove the pipe from the sand mold is shown in Fig. 4. As may be noticed, a hood is provided which is dropped over the entire equipment when the machine is in operation. Pipes from this enclosed hood carry the dust from the operation to a large dust arrester installation located just outside of the sand spun plant. Hoods also are provided for the sand mixing and handling equipment located in the basement, and pipes carry the dust from there to the arrester system. Once each year the plant is shut down and the entire building, including all the steel work, is given a thorough cleaning and all dust is removed.

An educational campaign which is conducted in connection with the cost of various materials used in the plant, reduces the total expenditure for such materials and at the same time tends to assist in keeping the plant clean. Cost of supplies always is the first item of business at the weekly foremen's meeting, of which incidentally the chairman of the employes representative committee is a member. Charts are used to indicate the quantity of supplies used daily, and when any large amount is required, an investigation is made to see if the supplies are being used properly, also if the materials received are best suited for the particular purpose for which they are intended. As an example, wheelbarrows formerly were purchased a dozen at a time, from various sources of supply. Standardization on one type of wheelbarrow, which it was found was best adapted to the particular needs of the plant, now permits interchangeability of parts and has reduced the total cost for wheelbarrows.

Through a carefully planned educational program, information has been presented to the workman so that he knows the value of each item he is using. In this way the workman has been taught to respect the property of the company which he is using. Before the workman can obtain certain types of supplies, as for example, a bucket, he must return the old item. This, of course, prevents the accumulation of such worn out material as rubbish on the company property. In addition, it has been found that numerous items, such as the buckets, may be worn out as far as one department is concerned, but that they may be used quite satisfactorily in another department for an entirely different purpose, and therefore, the costs of the second department are cut considerably.

Tools Are Inspected

An example of the method of storing tools in the maintenance department is shown in Fig. 11. In addition to the tools used by the maintenance crew, certain tools used in the foundry, such as portable pneumatic tools, chipping hammers, etc., are supplied through the maintenance department. Periodically, the tool in use in the foundry is exchanged for the one held in the maintenance department, and the tool which has been in use is checked, placed in good repair and held in readiness. Periodically, operating tools in the foundry are inspected by the maintenance department.

All of the tools used by the maintenance department are painted red, so that they may be identified easily in any part of the plant, and returned to the proper department. All tools are checked in and out, and every tool, when returned, is inspected carefully, and if necessary placed in good repair, before it is again located on the rack shown in Fig. 11. Motors, transformers, and other equipment of that type are repaired when sent to the maintenance department, and then stored ready for use when needed. Motors are arranged in straight lines and are card indexed, according to types and size, so that it is easy to procure the desired motor quickly as needed.

The maintenance department checks every chain used in the plant every four weeks and sees that the chain is annealed by the smith shop every 12 weeks. A check system and card index maintained in the maintenance department provides an accurate guide in the rotation of this work, and assures that the inspec-

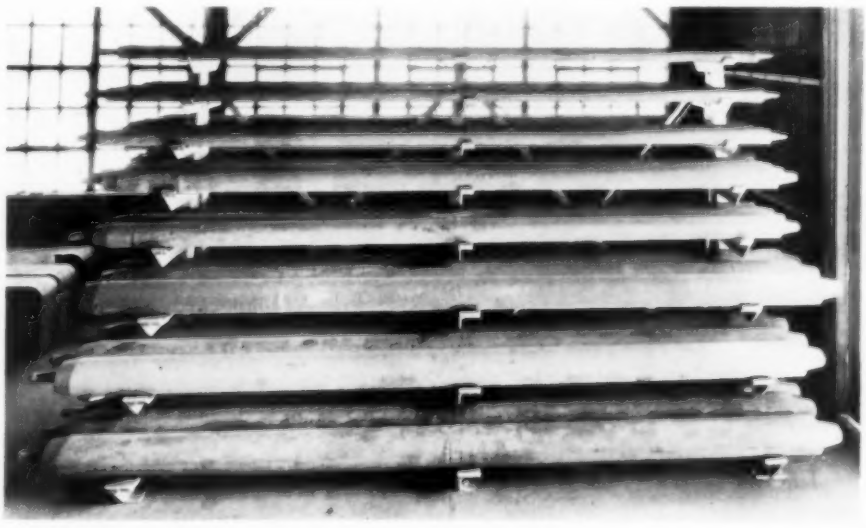

Fig. 12—Rack for body patterns in the sand spun pipe plant

tion and annealing operations will be carried on as scheduled.

The good housekeeping program is not confined alone to the interiors of the various buildings but extends throughout the entire plant area of over 80 acres of the Florence Pipe Foundry & Machine Co. The plant property is divided into zones, and each foreman has a certain zone which he must see is kept clean. This includes keeping the cement drive swept, the grass cut on the various plots around many of the buildings, and the entire grounds in his zone kept free from litter. This is done with men working on the regular job at times when they otherwise would not be employed, and is accomplished easily by those who do take pride in having clean surroundings. No extra men are required to maintain the grounds in the desired clean and presentable condition.

Locker rooms and wash rooms with large spray type wash basins and shower baths are maintained for every department and are kept spotlessly clean by the men themselves. The confidence which the management places in the men to keep every part of the plant clean, was well illustrated when the writer visited the various departments at Florence. Before starting the trip, his guide told of the splendid co-operation which is accorded both employes and management in connection with good housekeeping, and offered to buy a dinner if the visitor found as much as a burnt match in any of the locker or wash rooms throughout the plant. The dinner was not earned.

Reader's Comment

Interesting communications from readers of The Foundry

EDITOR'S NOTE — *Material Appearing Under this Head Does Not Necessarily Reflect the Opinion of* THE FOUNDRY *or of Its Editors.*

Advanced Ideas

TO THE EDITORS:

Permit me to take advantage of the present to answer your recent letter. I am grateful for the fine attention which you have shown me, giving me all types of material relating to foundry equipment.

I have in my possession three issues of your excellent magazine, THE FOUNDRY, which is published for the benefit of those engaged in that particular line. I have profited greatly from them and have studied the clear information that they contain, reporting many useful benefits.

I take this occasion to congratulate you very sincerely for the work which is put into your magazine, considering the thoughts published in it as being greatly advanced in their scope.

JUAN ESTEVEZ SALAZAR

Monterrey, N. L.

Elongation 6 Per Cent

TO THE EDITORS:

Referring to the transcript of my talk before the recent joint meeting in Chicago, which appears in pages 23 and 63 of the May issue of THE FOUNDRY, I find there is a typographical error important enough to require correction. In the next to the last paragraph I refer to a material with a tensile strength of 90,000 pounds, a yield point of 70,000 pounds and an elongation of 6 per cent in 2 inches. The elongation as printed on page 63 reads 16 per cent instead of 6 per cent.

The elongation of the material of 70,000 tensile and 50,000 pounds yield point was correctly reported as 16 per cent a few lines further on.

DUNCAN P. FORBES

Gunite Foundries Corp., Rockford, Ill.

Lead Poisoning

TO THE EDITORS:

Your readers may be interested in my experience with lead poisoning, and how I have avoided it in recent years:

I had a mild case of poisoning in 1891 and a severe case in 1905. Both resulting from smelting lead-silver ores. From 1905 to 1925 I smelted nonferrous metals and alloys including lead. From 1925 to 1935 I have done brass foundry melting of lead and zinc alloys. During the past 30 years, I have had no lead poisoning.

To anyone who works in lead dust or lead smoke, I would recommend the following rules:

(1) After the day's work, leave all clothing at the place of work, bathe, put on clean clothing from skin out.

(2) Wash the nostrils with a pint of warm water containing a teaspoonful of salt (sodium chloride).

(3) Before breakfast, take one teaspoonful of mineral oil, and the same amount of agar. Neither one has laxative properties.

(4) Wash the hands with soap and water before eating your lunch at the plant.

(5) Drink milk during working hours—a little every couple of hours.

(6) Chew tobacco continuously while at work, but not after working hours.

F. N. FLYNN

Arthur Harris & Co., Chicago

Always Bills

TO THE EDITORS:

My best regards to Mr. Pat Dwyer. Tell him I have very much to do with his foundry literature and would be very glad to know if he ever thinks how much trouble he does to the Russian ladies-translators with his foundry business shop slang. I like him very much to read. His Bill's Adventures, too. But yet he makes me sick with his miraculous for-all-the-reasons-risers. What does he mean by his risers? Tell him I am patiently waiting for his nice particular explanations. Just right away. Bills, always Bills. Macs too. And they were three Bills together in our foundry too.

MISS N. A. KOSTAREVA.

Chemical Research Institute, Kiev, 3rd Datchnaja 13, U. S. S. R.

Detroit Founders Install New Officers

Detroit Foundrymen's association installed its newly elected officers at the regular meeting held at the Detroit Athletic club, May 16, with Jesse D. Stoddard acting as toastmaster. The following officers were installed: President, Vaughan Reid, City Pattern Works; vice president, Leslie D. Korte, Riley Stoker Co.; secretary, Harry J. Deutsch, Aluminum Co. of America; and treasurer, Frank X. Mushynski, American Car & Foundry Co. Members of the executive board are as follows: Leslie G. Korte, chairman; R. Blair Crawford, Atlas Foundry Co.; Harry W. Dietert, U. S. Radiator Co.; Ira F. Cheney, Griffith Wheel Co.; Harry Rayner, Dodge Bros. Inc.; and Hugh Martin, Detroit Gray Iron Foundry; Jesse D. Stoddard, The Detroit Testing Laboratory, was made A. F. A. representative.

V. C. Crosby, Climax Molybdenum Co., Detroit, presented an interesting talk on "Core Binders", which aroused considerable discussion following the formal presentation.

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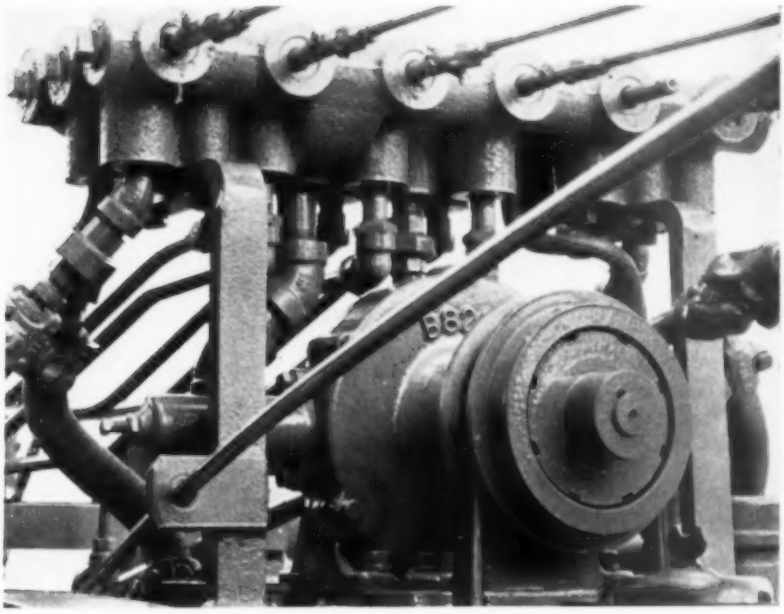

Hydraulic Pump and Manifold for Road Scraper Control

THE above castings are standard on all road scrapers made by one of the largest builders of road machinery in the world. The losses on these castings were high due to porosity which could not be discovered until after machining and a pressure test applied. An introduction of a regular quantity of GLOBE ALL ORE SILVERY PIG IRON into the foundry mixture reduced losses 80 PER CENT. The new mixture cost less than the previous one.

This is only one of many similar cases where the regular use of GLOBE IRONS in foundry mixtures has proven beneficial and economical.

- Some of the many reasons for improved quality and better economy—
- Silicon content sufficiently concentrated for proper deoxidation—not concentrated to such an extent as to cause ununiformity of metal poured.
- Low carbon allows better control of grain size where added strength with good machineability is desired. Less graphite segregation.
- Uniform hardness throughout casting—No complication in cupola practice. Soundness in thick and thin sections.
- Flexibility in mixtures for various grades of work without large inventories.
- No alloy complications due to alloys building up in scrap—No alloy price extras. Lower mixture cost than conventional foundry mixtures.

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We Invite Consultation.

GLOBE IRON COMPANY

JACKSON, OHIO

ORIGINATORS OF SILVERY PIG IRON

Founding High Test Cast Iron

(*Continued from page* 29)

to obtain the microstructure and the physical properties specified.

This specification we feel is quite typical of the new requirements in high strength iron, and indicates the desire of engineers to co-operate with the foundry in arriving at some particular desired microstructure. In the past we have been tied too completely up with a specification, which, if made chemically, would not produce the brinell hardness specified. In that case the foundry has been held liable for such castings, probably of too high a brinell to obtain ready machinability.

Assume that we have an iron melted according to the previously mentioned specification. When and how are we going to pour it? If the casting is not poured at the proper temperature, with the proper gates and with the proper volume, certainly the best made mold not always will produce a saleable casting.

The first problem is that of sand. As a general rule, high test irons are poured hot, and of course are much more severe on sand than high carbon, low temperature irons of a short while ago. Heavy sections are made best in skin dried or dry sand molds. Light sections 3/16-inch to medium sections of ½-inch should be poured into sands with a low amount of fines. As these high temperatures have a severe eroding action at the gate area, synthetic sands are perfectly satisfactory. A point to be noted is that synthetic sands air dry sooner than natural molding sands. If a mold has to be left for any length of time, sprues, gates, risers, will have corroded edges. This can be helped by using a gluten or kerosene spray at those particular areas. This is not a severe problem in a continuous type foundry, but will cause considerable trouble in a jobbing foundry.

Cores Constitute Problem

Cores for castings poured extremely hot also constitute a problem. If the core can be vented readily, it should be coated with the best core wash obtainable. If the core is intricate and has to vent itself through the cope, it cannot be coated and an open core with the best grade of core oil is recommended.

In connection with that type of casting our experience recommends that they be poured hot, but slow. Shrinkage on the irons seemingly is in proportion to the carbon content, where uniform melting operations are maintained. Of course there are many other contributing factors besides the carbon content, such as design, which has a great influence on pattern contraction or liquid shrinkage. We suggest normally 5/32-inch shrink, but on some designs little or no contraction takes place. A sleeve type casting poured on end will take a normal shrink on the diameter, but little or none on the overall. The only answer to most of this is experience. No hard and fast rule can be set up except for castings of the same general type.

Practical Aspects

To produce high test gray iron castings which will meet the desired specifications, the author has pointed out it is necessary to have consistency in practice. Many practical aspects of founding iron of 30,000 pounds per square inch tensile strength and over are presented in this article, which is abstracted from a paper presented at the recent East Lansing, Mich., sectional meeting of the American Foundrymen's association, Michigan State college and the Detroit Foundrymen's association.

Every foundryman has his scrap sheet. Usually it is just what the name implies—a scrap sheet—battle field of departments, where each department will pass the buck as to responsibility for defective castings. But how many have faulty gating and risering on the defect sheet? It is interesting to note that even such a simple thing as a weight can cause some 27 different mold defects. Therefore, it is not always easy to allocate the cause of various scrap losses.

It is the writer's belief that a large quantity of defective castings blamed on the molder or sand, are due to defective gating and risering. The type of gates and risers to be used is reflected, of course, by temperature and melting conditions.

High strength iron requires plenty of coke. A ratio of 5 or 7 to 1 should not be considered as out of line. If the bed coke gets low the iron may melt hot, but will be short lived or *dead* as the molder says—*oxidized* as we know it. Castings will show up at the next day's funeral service with plenty of gas holes beneath the cope surface. These will have bright shiny walls, and frequently a pretty little shot squeezed into the cavity. Generally the bed was too low in this case. Again, gas holes of a dark variety may be found. These generally are caused by improperly vented cores or molds. Most of the difficulty on gas condition is caused by improperly operated cupolas.

As high test irons, generally speaking, run under 3 per cent total carbon and have a ready tendency to oxidize, epecially in a cupola process, it is a safe plan to keep the bed high. Oxidized metal acts in contrary ways in the mold. Castings will shrink today that didn't shrink yesterday. Due to the rapid setting of the metal risers do not have time to feed and are frozen off. Cases have been noted where the gates did not run. The iron pourers will be charged with pouring dull iron, and yet this iron may have been plenty hot. As a general rule, we advocate pouring low carbon irons hot. However, these irons have a tendency to form a dendritic structure if melted at a temperature over 3050 degrees Fahr. This is especially true if poured in light sections.

As an illustration of this a series of tests was run to determine the pouring temperature of an electric iron of 3.20 per cent total carbon, 2.12 per cent silicon, 0.72 per cent manganese, 0.20 per cent phosphorus, 0.025 per cent sulphur. On one typical example melted at 3100 degrees Fahr. and held in the ladle to 2400 degrees Fahr. and then poured, a ¼-inch section gave a beautiful spider web construction with a brinell of 220. This iron was plainly dendritic. On another heat of the same analysis with the maximum temperature 3050 degrees Fahr., the casting was poured directly from the furnace. Again, the ¼-inch section had a similar appearance and practically the same brinell hardness of 217. However, upon etching that sample, instead of a free cementite area as in the superheated and cold poured metal, we had a free ferrite around the grain boundary.

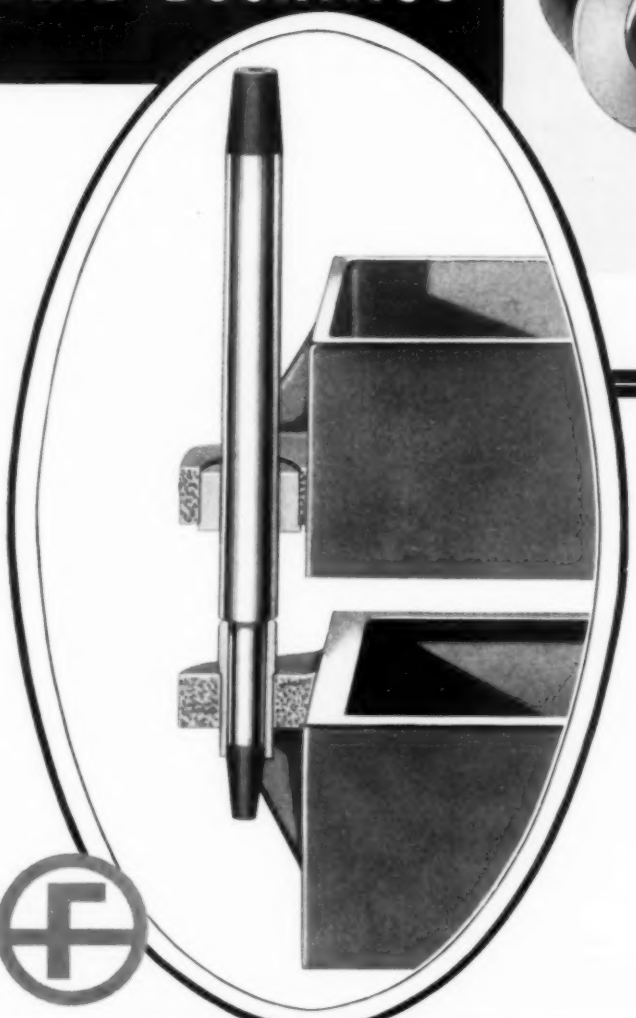
Iron Cooled Too Rapidly

We have explained this phenomenon to our satisfaction, in that the last iron was cooled too rapidly, and in the first excessive heat had oxidized or deoxidized the iron until the freezing point was raised, with the consequent precipitation of cementite and a resultant mottled iron.

Gating a casting should be governed by design and experience with the metal. We have cast a low carbon solid bushing 6-inches in diameter, 12-inches long, poured through a single gate ¼-inch in diameter. No riser was used on the casting; yet only a slight pulldown occurred on the top. In the same casting made with a conventional gate, a heavy riser was necessary to get a similar soundness and consistent brinell hardness. However, from a practical standpoint it was desirable to use the riser because the iron could be dumped in the mold. With a gate the size of a pencil the iron

(*Concluded on page* 68)

Interchangeable FLASK PINS AND BUSHINGS



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2—They prevent wedging

3—The drag cannot shift

4—Easily and inexpensively installed with standard reamers

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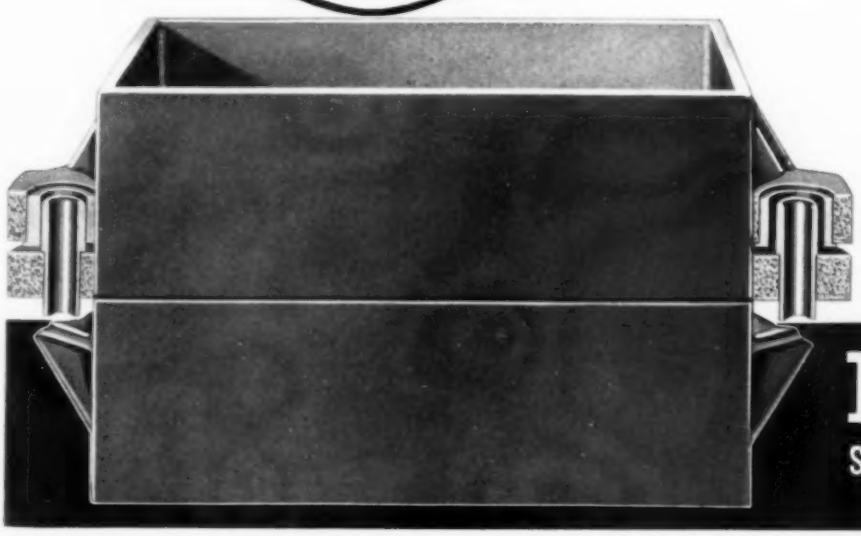


FEDERAL
SCREW WORKS·DETROIT

(*Concluded from page* 66)

pouring was slowed up so much that the saving in extra metal and riser, etc. was overcome by the additional labor required.

Again, with cupola metal we generally gate on the thin section and riser or chill the heavy section, depending upon rate of pouring, to cause uniform setting of the metal. Due to the shortness of the setting range of low carbon irons, as evidenced by similarity of structure in light and heavy sections of the same casting, on many castings we have reversed that process, and by gating in the heavy section we avoided supercooling in the light section. We also can have that gate a combination feeder and gate, with a strainer gate to riser to casting combination. The iron enters the casting gently by that method, causing no mold wash, and leaving a clean dense casting.

Harry W. Dietert has written several fine articles on gating and pouring of castings, and in general his rules will apply. However, in these irons of a higher freezing point it is necessary to get the iron into the mold with the least delay possible, and also the least disturbance of the metal. Have the gates enter as low on the casting as design will permit, and in all cases use a relief sprue so that the iron can be forced into the casting without danger of strains or swells. Do not have the cope too shallow. Under general jobbing conditions where only a few castings are to be run, it is a lot safer to have 2 inches extra cope than to have one ¼-inch too shallow. Low carbon irons, if melted right and poured hot, feed well.

Touch Up the Riser

In checking over many scrap castings, all too often it will be noticed that the gate sprue is drawn down to a lower level than the height of the casting itself. Therefore the sprue and riser should be kept full. When in doubt have a follow up man touch the risers up with hot metal.

We are at present running a job of low carbon iron which, due to the peculiar design, is top poured, and shrinkage has been entirely overcome by having a 2-inch deeper pouring basin.

High test iron castings are not particularly susceptible to crack if shaken out hot, provided of course the castings are gated and risered properly and poured at the correct temperature. Another feature is the fact that these irons do not distort upon machining. This, of course, one would normally expect from a structure that shows great uniformity from thin to heavy sections.

It is our experience that castings which show a wide brinell range from thin to heavy sections are indicative of casting strains and will distort when one surface is removed by machining much more readily than a casting which has an evenness of microstructure as indicated by an average brinell hardness.

Of course, design must be considered when contemplating shaking out hot or even if the resultant casting has a hardness quite uniform throughout the heavy and light section—a casting with a ¼-inch section joining a 2-inch block—it is better not to shake out too hastily. In case it is necessary for some machine requirement to normalize or alter the brinell by heat treatment, these irons have a decided lesser tendency to go out of shape than castings of a wide brinell range.

Use Nickel and Chromium

Research work on low carbon irons, especially in Europe, indicates that the lower the total carbon down to 2.50 per cent, the greater the percentage of silicon which can be used without excessive graphite precipitation in heavy sections. This is important because in the types of irons obtained with a low silicon high carbon combination, it is necessary to use an alloy which will prevent the graphite formation in the heavy section, while controlling dendritic formation in the lighter section. Use of nickel and chromium for that purpose is well known. It is not to be inferred that the use of low carbon irons has eliminated the use of alloys. On the other hand, it has increased their efficiency, or effectiveness. An 0.35 molybdenum content, for example, in a 2.60 total carbon iron has a much greater effect on the tensile strength of that iron than twice the amount in a 3.50 total carbon. Nickel in a 3.50 iron up to 0.70 per cent has little influence; yet it has a decided effect upon a low carbon iron at half that value. A pinch of chromium is lost in high carbon irons, but has an exaggerated effect in low carbon irons.

There is one point I would like to stress and that is the use of the word semisteel. Semisteel is a misnomer, and yet it is one of those words which has grown upon our industry. It still causes us a lot of unnecessary explanations.

From a practical standpoint, steel is utilized as an alloy or a material to control the carbon content of the metal. Twenty-five per cent steel added to the cupola charge does not give a casting with a 25 per cent similarity to steel; it does not give a 10 per cent or 5 per cent similarity. The product still is cast iron. We may analyze a casting for its chemical content, examine its microstructure, but we have yet been unable to ascertain by any of these methods whether steel was or was not used in the original mixture.

A foundry we know of is operating today with 100 per cent steel mix in the cupola, producing a 3 per cent total carbon iron of 1.80 per cent silicon, and making a mottled unmachinable iron. Another foundry uses a 100 per cent mix, producing a 4 per cent total carbon iron with an 0.83 per cent silicon, which is a weak and open grain iron.

We have heard it stated that it is not practical in cupola practice to melt irons of 2.60 to 2.70 per cent total carbon, and in this we heartily concur where the operation is only spasmodic. It is difficult to run an iron of that type in the early part or the tail end of the heat and obtain the desired analysis consistently. However, it should cause no serious difficulty to set up a cupola to run that analysis as a standard practice. A 2.60 total carbon iron with 3 per cent silicon content has approximately the same solidification point and will run sections as compared with malleable.

There is one other point which is brought daily before the foundryman making the high test irons, and that is machinability. There is a relation between brinell hardness and machinability. Certainly, an iron of 228-241 brinell will not machine as readily as an iron of 165-185 and to the foundryman who is endeavoring to do a good job this becomes a problem of educating the consumer on what he may expect in machinability.

Book Review

Proceedings, American Society for Testing Materials, 1934, Parts I and II, published by the A.S.T.M. and supplied by THE FOUNDRY, Cleveland, at $5.50 each in paper, $6.00 in cloth, $7.00 in half leather, plus postage.

Part I of the *Proceedings* deals with the annual report of 44 A.S.T.M. standing committees, including cast iron, corrosion, magnetic properties, ferroalloys, iron-chromium-nickel and related alloys and effect of temperature. A number of technical papers also are included.

Subjects in the nonferrous metal field include corrosion in liquids and galvanic and electrolytic corrosion, electrical heating and similar alloys, copper and copper alloys, die cast metals and alloys, and service characteristics of the light metal alloys.

Part II includes the extensive oral and written discussions in addition to all of the formal papers presented at the 1934 meeting. In the metal section, papers and discussion include the following subjects: Aging embrittlement of 4 to 6 per cent chromium steel; creep properties of chromium-molybdenum steel still tubes; interpretation of creep tests; soil corrosion data; frictional resistance of steel and brass in shrink fits; strain measurements; and effect of test specimen on observed physical properties of steel.

ADVERTISING PAGES REMOVED

Pittsburgh Foundry Casts Guns

(*Concluded from page* 31)

In a later edition under the heading Pittsburgh Foundry, Joseph McClurg respectfully informs his friends and the public that his AIR FOUNDRY is now in complete operation, where he will execute all kinds of CASTINGS in the best manner, and also machinery of whatever description, cast of any given pattern.

Execution of all kinds of castings would seem to present a sufficient program for any ordinary man. Mr. McClurg was not an ordinary man, as witness the following continuation or supplement to the foregoing notice:

He also continues to carry on the Manufacture of Tobacco. And has now on hand a Quantity of PLUG AND PIG TAIL TOBACCO, SEGARS AND RAPPEE SNUFF, equal if not superior in quality to any manufactured in the STATE, and lower in price than it can be bought here.

He Has Likewise on Hand

A handsome and general assortment of GOODS. Suitable for the present and approaching seasons. ALSO a large and general assortment of NEW GENEVA Window and Hollow Glass of a superior quality, and at the Pittsburgh prices. Merchants descending the Ohio, and others will find it to their interest to call on him.

Apparently he was as successful in disposing of tobacco, window glass and other Goods as he was in the manufacture and sale of castings. At the end of twenty years he had acquired a comfortable competence. He turned the management of the foundry over to his son Alexander and retired. This feature was touched upon by one S. Jones in *Pittsburgh in the Year* 1826 and published in that year. Under the heading AIR FOUNDERIES Mr. Jones informs all and sundry:

There are few even in our city who are aware of the immense business that has been done and is now doing in these establishments. There are no less than eight of these in full operation. The Pittsburgh Foundry was erected as early as the year 1804 by Mr. Joseph McClurg and was the first establishment of the kind west of the mountains. The opposition that Mr. M. met with from his friends shows how limited the views of the citizens of that period were in relation to the important situation of Pittsburgh and the great sources of wealth that lay around it. Many thought at that time that Mr. McClurg would certainly be ruined—that a foundry was useless—and that he could not possibly succeed. He persevered, however, and subsequent years have shown the fallacy of human prognostication. He realized a fortune. Has retired from business and left the old foundry to fill the pockets of his successors with better stuff than pig metal.

The Pittburgh Foundry is at present carried on by Messrs. Alexander McClurg, Cuthbert & Cuddy on an extensive scale. There are two furnaces which are daily in use and the amount of metal that is converted into wheels, shafts, cannon, stoves, hollow ware, grates and all manner of castings is about 600 tons per annum. From 25 to 30 hands are constantly employed and yearly about 15,000 bushels of coal are consumed. The value of the castings is from 65 to 70 dollars per ton, consequently the manufactures of this foundry amount to 40,800 dollars per annum.

The present proprietors have now a large contract with the government for furnishing 90 pieces of ordnance, from 6 to 24 pounders. To gentlemen who are fond of particularities or who are ignorant of the scrupulous exactness with which the business of the ordnance department is conducted at Washington, it would be worth a walk to the foundry to see the drawings of a 24-pounder. Beside the master hand that is visible in the sketch, there is nothing can surpass the correctness with which every part is laid down and the minuteness with which every "jot and tittle" is required to be executed.

In order to facilitate the operations of boring these pieces, the contractors intend to put up this summer a steam boring mill, to which will be attached machinery for turnings, grinding, &c. This branch being heretofore done by horse power. McClurg & Co., have two large warehouses—one at the foundry, corner of Smithfield and Fifth streets and the other in Wood, between Front and Water streets, where may be seen some fine specimens and patterns in their line.

Further expansion of the business of the company is noted in *Harris Pittsburgh Business Directory* for the year 1837 under the following heading:

PENN FOUNDRY AND STEAM ENGINE FACTORY

Of Messrs. McClurg, Wade & Co. Is situated at the corner of O'Hara and Water streets in the Northern Liberties and is the only Foundry to the west of the Allegheny at which locomotives, steam engines, heavy cannon and field artillery are made. Besides these, however, there are manufactured rail road cars and rail road machinery of all kinds, engines for the steam boats, mills and manufacturers, gun carriages, cannon balls, shells, grape and cannister shot, and castings for mill machinery. The establishment has in operations three steam engines of ten, thirty and thirty five horse power. Gives constant employment to 29 workmen; consumes annually 75,000 bushels of coal; uses 1600 tons of pig metal, 150 tons of bar iron and 20 tons of steel. Messrs. McClurg, Wade & Co., have a warehouse at 88 Front street at which a large assortment of castings, manufactured at their works are kept for sale. The total annual value of the product of their establishment is $300,000.

As Pittsburgh grew, the company grew. The history of one is inextricably intertwined with the other. The history also illustrates some curious coincidences. Thus the first plant was functioning smoothly with a trained personnel when the American government needed a source of supply for

Famous Firsts

1823—First chilled roll west of the Allegheny mountains
1835—First chilled roll patent
1842—First chilled rolls in United States for rolling brass
1867—First vertical blast engine
1871—First commercially designed universal mill
1888—First steel rolls
1896—First alloy steel rolls
1902—First continuous hot strip mill
1910—First high carbon steel rolls
1914—First grain type rolls
1921—First to use molybdenum in rolls
1927—First nickel-chrome hard iron rolls
1928—First nickel chill rolls
1928—First successful alloy steel rubber rolls
1930—First successful application of zone-surfacizing treatment in duo-texture metal
1934—First reversing hot strip mill with coil furnace

Typical Jobs

1812—Cannon built for Perry's fleet
1848—Guns for Mexican campaign
1879—Built blooming mill for English firm
1881—Built 3-high rail mill for Homestead Works
1887—Built 32-inch universal mill for Homestead Works
1888—Secure patent on universal mill construction
1891—Built 34-inch plate mills
1894—Built 44 x 60-inch blooming mill engine. Still working to capacity
1899—Built continuous rod mill
1900—Built 40-inch blooming mill
1907—Cast and machined one piece bed plate 26'-6" long, 8'-0" wide, 12'-1" high, weight 235,100 pounds
1919—Advocated and submitted design of 4-high strip mill
1926—Largest gear rack ever cut—25'-2¾" O.D., 21¼" face, 7½" CP
1930—Largest and heaviest double helical mill pinion ever cut—61.812" O.D., 72" face, 9.425 CP—weight 56 tons
1931—Largest double helical gear ever cut: 23'-0" O.D., 54" face, 3.1416 CP, weight 72 tons
1934—Developed and built high speed 3-high sheet mill with automatic preset control and balanced rolls

war equipment on the frontier beyond the mountains. Similarly when Carnegie set his brood of industrial young steel giants to the task of flooding the country with steel the company was in position to design and manufacture the necessary equipment. Two names stand out prominently in this era of industrial expansion, James Hemphill and Joseph Fawell. When James Hemphill died in 1900 a Pittsburgh newspaper stated: "The magnitude of the present development of the steel industry may be said to rest almost entirely on Mr. Hemphill's forcing the reversing blooming mill to the front. This mill he put in at the Pittsburgh Bessemer Steel Works, the small plant from which the great Homestead Works of the Carnegie Steel Co. has developed. Reversing mills for steel had been made before, but had been failures, very largely from the lack of that massiveness and strength which Mr. Hemphill always kept in view."

Homestead, greatest of American steel plants was conceived, designed, constructed and equipped by James Hemphill. He turned it over to Mr. Carnegie with the laconic comment: "There it is Andrew. Take it. A mill without a rival in the world today." He was offered a partnership by Mr. Carnegie, but declined. He preferred individualistic freedom to realize ambitions, visions and plans which laid the foundation and reared the structure of Americ a's steel supremacy.

In addition to equipping the majority of mills in the United States the company has built mills for many foreign steel plants. Over a period of 60 years from 1868 to 1934 Mackintosh-Hemphill has produced 694 mills, an average of one mill for every 34 days, a record average of nearly a mill per month.

The present company represents a merger of the A. Garrison Foundry Co., Pittsburgh Iron & Steel Foundries Co., Pittsburgh, and Woodard Machine Co., Wooster, O., with the original Mackintosh-Hemphill Co., Pittsburgh. Miscellaneous iron castings and iron rolls are made at the Pittsburgh plant. Alloy iron and steel castings and rolls are made at an extensive plant in Midland, Pa. Interesting features in foundry practice at these plants will be presented in early future issues of THE FOUNDRY.

This is the first of four articles covering history and present activities in plants of the Mackintosh-Hemphill Co., Pittsburgh. The second, dealing with roll practice in the iron foundry, will appear in an early issue.

THE EDITORS.

Nickel Alloy Has High Silicon Content

International Nickel Co., Bayonne, N. J., recently has introduced a new metal known as S Monel, which is similar in analysis to regular monel, the essential difference being in the silicon content which is raised to a maximum of 3.75 per cent. In properties, the material has a higher hardness and greater resistance to wear and erosion, particularly steam erosion. A feature claimed is that the metal is nongalling, especially at high temperatures.

The as cast material can be machined without difficulty if the hardness is held to 325 brinell by limiting the silicon to 3 per cent. Other grades must be softened before machining and later rehardened by heat treatment. The metal is said to have from 100,000 to 120,000 tensile strength in pounds per square inch, a yield point of 90,000 to 110,000, elongation of 2 to 5 per cent in 2 inches, a reduction in area of 2 to 5 per cent and a brinell hardness of 275 to 350.

Design of Balanced Blast Cupola

(*Concluded from page* 33)

where *scaffoiding* or *bridging* has taken place. One large balanced blast cupola is working continuously for 18 hour periods quite successfully.

The question of wear on the lining also sometimes is raised with regard to the new cupola and it might be anticipated that the higher melting temperature would cause more wear on the lining. However, that has not proved to be the case, and in most instances wear on the lining is no more severe than would be experienced in a normal cupola. In several cases the wear has been much less severe.

During the past 2 or 3 years nearly 100 cupolas have been either installed or are under construction, the most satisfactory feature being that firms which originally converted one cupola have soon converted all their cupolas. One of the largest iron foundries in England now is converting its seventh cupola to the new system. Balanced blast cupolas also have been installed on the Continent of Europe, in India and Australia. One American firm, that converted a large cupola last year has begun the conversion of its second cupola. That firm reports a saving of approximately 33 per cent of coke and also that scrap, due to shrinkage, has practically vanished. The cupola was started up without any difficulty from written instructions supplied by the British Cast Iron Research association.

Air Conditioning Manufacturing association met at Hot Springs, Va., May 23, and elected the following officers: President, P. M. McKittrick, Parks-Cramer Co.; vice president, J. F. G. Miller, B. F. Sturtevant Co.

Quad City Group Forms A. F. A. Chapter

Foundrymen of the Illinois, Iowa area adjacent to Davenport, Moline, and Rock Island and organized as the Quad City Foundrymen's association have decided to affiliate with the American Foundrymen's association as a chapter of the latter organization. At a meeting held in Moline, May 20 the following officers of the new chapter were elected: President, A. E. Hageboeck, Frank Foundries Corp.; vice president, Thomas Frank, Frank Foundries Corp.; secretary, J. Morgan Johnson, secretary of the Tri-City Manufacturers' association.

The following will compose the board of directors: P. T. Bancroft, H. Bornstein, F. W. Kirby, John H. Ploehn, C. F. Scherer, M. J. Gregory, H. F. Henninger, Clyde Burgston and E. W. Gullberg.

Brief addresses were given by C. E. Hoyt, executive secretary; Robert E. Kennedy, technical secretary and Dan M. Avey, president of the association, who were guests of the Quad City group. The principal address was delivered by Gen. T. S. Hammond, Whiting Corp., Harvey, Ill. General Hammond, who was in charge of the organization under the present reemployment agreement during the formative days of NRA, outlined his experience and observation relating to NRA and other factors in business and legislative experience.

Book Review

Marketing Industrial Equipment, by Bernard Lester; cloth, 307 pages, 6 x 9 inches; published by McGraw-Hill Book Co. Inc., New York; supplied by THE FOUNDRY, Cleveland, for $3.50, plus 15 cents for postage; in Europe by Penton Publishing Co. Ltd., London.

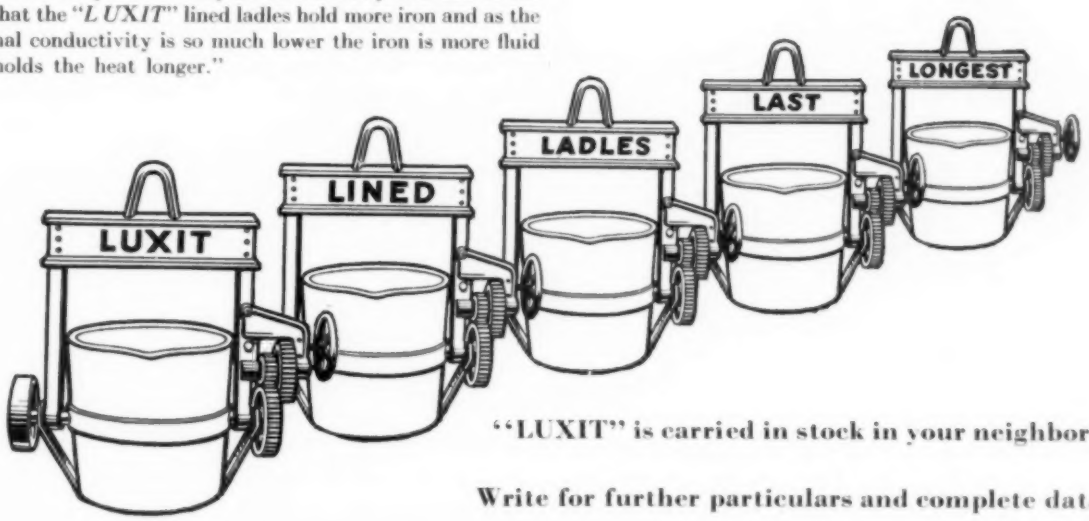
This book presents an outline for a study of the distribution of durable or capital goods of an engineering nature, from the manufacturer to the ultimate user. It is intended to assist those engaged in various phases of the distribution of machinery, equipment and engineering supplies, as well as students in technical and business schools.

The present volume grew out of a series of lectures at the University of Pittsburgh, starting in a small way and eventually broadening into a regular course. To give wider distribution it was compiled into book form.

No effort is made to teach high-pressure salesmanship but rather the way is pointed to a careful analysis of product, markets and competitive distribution. Proper organization of the sales department is covered carefully and in customer analysis and sales promotion new points of views are presented.

Use "LUXIT"—*The Monolithic Lining On Ladles*

One of our customers says about "LUXIT":—"Daily heat 130 tons. Ladles formerly lined with clay and fire sand mixture two inches thick and lined daily. Now lined with "*LUXIT*" ¾ inch thick and run six to ten weeks without relining. This firm required 13 men pushing ladles around the shop. Now only 11 men are required due to the fact that the "*LUXIT*" lined ladles hold more iron and as the thermal conductivity is so much lower the iron is more fluid and holds the heat longer."



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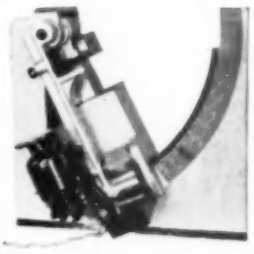

Universal Sand Strength Machine Type C. P.

676 W. Grand Blvd. **HARRY W. DIETERT CO.** Detroit, Mich.

Hard to part with an old friend

The Adventures of Bill

BY PAT DWYER

KINDLY rally around," I said to Bill the other night. "Questions of vast import are to the fore and I would have your rede, your opinion, your most carefully considered advice on what probably will rank in future years with the decisions rendered in the Dred Scott case, the Alaskan Boundary Dispute, the extradition of Simuel Ansull, Section 7*a* under the Blue Eagle and the King *vs.* Bluebeard *et al.* In a word—"

"In a word you want me to help you make up what you call your mind in deciding whether to give the old blue suit to your gardener or chauffeur. With charity for all and malice toward none I suggest that you save yourself the embarrassment of a refusal from both of these worthy individuals, by bestowing the shiny reminder of better days on the bird who comes around carolling the well known roundelay 'Any rags, any bones, any bottles today.' What you really should have done a few months ago, was to take the thing with a pair of tongs and shove it in the furnace. Now if I was in your place—"

"If you were in my place, you would count ten and allow that violent imagination of yours to come off the boil and kind of settle down. Your reference to the faithful old suit is in poor taste—"

"Har, har. So is the suit. I think the fella who made it must have cut it out with a hammher and chisel or maybe with a knife and fork. All you need is an old brown dip squashed down over your ears to play the part of the seedy villain who is run over by a train in the last act. I bet you would be a knockout."

"Don't tempt me too far, Jack Dangerfield. Too long have I endured in patience your poisonous jibes and sly innuendoes. Some day, mark my words, the worm will turn and knock you out from between your ears. In the meantime while you still are attached to these more or less useless appendages you might lean them in this direction. Incidentally you might take pattern from little Billy Hooty in the old ivy tree. Little Billy kept his eyes and ears open and his mouth shut when the fox appeared on the scene."

"So now you are a fox, hey? Old foxy gran'pa himself in person. And what has gran'pa got on his mind today, besides rheumatics, the usual crop of moth eaten whiskers and a drooling under lip?"

"That's the proper spirit. Now that you show a proper and respectful degree of curiosity, I shall have the pleasure in—Ah—I believe the term is 'Spilling the beans.'"

"Spill away," Bill chanted, "Spill with care, spill in the presence of the passenjare. Of course Mark Twain thought of that first, but it is still good."

"Wait until you hear this list, if you want to hear something good. It was sent me by a young man who fell heir to the ownership and management of a foundry about a year ago. He claims that his melter is nothing to brag about as melters go, but as a maker of excuses he probably is without a peer in these United States, if not in the entire civilized world. This young foundry owner regrets that he is not sufficiently familiar with all the nice technical details of melting, to pass upon the validity of these excuses, but some of them are so extraordinary, that he is inclined to doubt them all.

"He says that he shall appreciate a perfectly unbiased, expert opinion on the various items. After reading the list I decided that no one man could handle the assignment alone. Hence the loud call for assistance you heard some time ago. I now shall serve you with the papers in the case, after which the court will take a recess while you study the indictment and decide whether the defendant is innocent or guilty, and if so, as hereinbefore stated, to wit, i.e., e.g., etc., and *carp diem*, is the aforesaid accused to be discharged or condemned as the case may be in the judgment of the court for forgery, perjury, malfeasance in office, high treason, dealing with the enemy, or acts prejudicial to the safety of the realm. In other words—"

"In other words," Bill interrupted impatiently, "In other words, 'So what?' Le's see the paper."

I handed him the list of which a faithful fac-simile is presented (I nope) elsewhere, which means on the following page.

Looks more like a game of leap frog than a stick-up

"Well," said Bill after he had read every one of the 40 items, "I'll tell you. Without a shadow of a doubt your young foundry friend has a most remarkable melter, ingenious and resourceful to a phenomenal degree. Until I read this list I thought I had heard, at one time or another, every possible excuse for poor melting practice, but this bird apparently knows twice as many. Just goes to show that there is always something left to learn. Certainly I appreciate this opportunity of increasing my stock of knowledge on the subject of melting iron in the cupola.

"I shall not attempt to analyze the more obvious items, what you might call the stock excuses known to every melter. Manifestly no person reasonably could expect a cupola to melt where the coke is no good. The air tight alibi in No. 18 'No more coke' needs no defense. The same applies to No. 27 'Forgot to put coke in the cupola.' Even an outsider, a person with absolutely no knowledge of the foundry, readily could understand that iron will not melt in a cupola or elsewhere without fuel. Reading between the lines I should be inclined to place the blame on the foundry owner, rather than on the faithful melter. Centuries ago the haughty Egyptians tried a somewhat similar stunt by insisting on the manufacture of bricks without straw. Well, you know what happened. The brickmakers coaxed them down to the Red sea one fine day and drowned 'em all like so many kittens in a bag.

"Fat pigs will ruin any heat. They are notoriously sluggish, filled with impurities, grunts and squeals. It is a well established fact that the physical properties of the pig in the charge are transmitted through every successive melting. At one time or another the foundryman has been invited into the machine shop to listen to the agonized squeals of a casting on the lathe or boring mill. Scientific birds, of course attempt to explain this phenomenon by glib reference to the carbon and silicon content of the metal. All piffle, my dear Watson. The squeals are directly inherited from the fat noisy pigs.

"Cupola sprung a leak. Well, why not? No blame attaches to the captain of a ship when she springs a leak. When she finally makes port the newspapers carry thrilling accounts of how the master kept his men at the pumps night and day. His picture appears on the front page and the owners present him with a watch charm. When a cupola springs a leak, the foundry owner, as in the present instance, kind of hints that the melter is one of these here now reds, boring from within. The melter is perfectly justified in standing on his constitutional rights in claiming that a leak in the cupola is as legitimate as a leak in the tea kettle, in the roof or a leak in the sole of your shoe.

"Not enough stickum in clay. Every once in a while an indignant citizen forced to pay extra postage on a letter from which the stamp has fallen off for want of stickum, writes to the paper with a view of organizing a league or an association. This league to adopt resolutions condemning the government for niggardliness in spreading an adequate amount of stickum on postage stamps. Possibly a similar league may be established to regulate the stickum content of clay. The objection may be advanced that the cases are not analogous since the melter does not apply the clay with his tongue. That is a distinction without a difference. Why should a man use his tongue in daubing a cupola while he has a pair of perfectly good

The foot is quicker than the eye

long, strong and red hairy paws?

"Brick fell on melter's head. I have not heard this excuse advanced in recent years, but when I was a boy it was fairly common especially on March 17 and July 12. With the melter laid out stiff the shop had to knock off for the day. This gave the boys a chance to parade in the afternoon with shoulder sashes, fife and drum bands and gorgeous banners.

"Rock got in melter's eye. This is a perfectly legitimate excuse. You can't expect a man with a rock, all sharp edges and as big as a marble in his eye, to perform his duties as serenely and peacefully as—say—a farmer sitting by the fire sucking cider through a quill. A melter can creep around on his hands and knees and make up the bottom in semi-darkness. He can help himself to a chew of tobacco, and wipe his eyes and nose with mud bedaubed fingers, he can endure grains of sand and small fire brick splinters in his eyes for hours at a time, but when it comes to poking rocks in his eyes, well, all I have to say is that is going just a trifle too far.

"Stockman ran elevator through roof. Is that the stockman's fault? No, indeed. The blame if any should be divided between the man who built the shoddy roof, and the elevator manufacturer. The defence of the roof maker probably would be that his roof was designed and built to resist pressure from above. That is a mere quibble, an equivocation, a subterfuge. A roof should be as strong on the inside as it is on the outside. However, to prevent a repetition of this accident I should recommend the installation of STOP and GO signs at the top and bottom of the elevator shaft.

"Tried to melt with wood. As one of the old school of foundrymen I could have told the poor misguided melter that he could not melt iron in a cupola with wood. Wood is all

Melter's Excuses for Poor Melting

1. Coke no good.
2. Pig too fat.
3. Scrap too large.
4. Fire brick too soft.
5. Wind from the north.
6. Fire wouldn't light.
7. Iron got in tuyeres.
8. Elevator broke down.
9. Cupola bottom fell out.
10. Cupola sprung a leak.
11. Wind pipe fell off.
12. Blower bearing ran hot.
13. Coke too small.
14. Fuse blew out.
15. Belt slipped.
16. Sulphur in coke.
17. Forgot to light up.
18. No more coke.
19. Not enough stickum in clay.
20. Fire-wood too wet.
21. Not enough wind.
22. Brick fell on melter's head.
23. Rock got in melter's eye.
24. Stockman, too much vino.
25. Stockman ran elevator through roof.
26. Cupola breast gave way.
27. Forgot to put coke in cupola.
28. Tried to melt with wood.
29. No more oil.
30. Lining fell out of cupola.
31. Forgot to ram sand in cupola bottom.
32. Somebody dropped the bottom.
33. No good melt, Friday the 13th.
34. Slag ran out charging door.
35. Tuyeres all burned up.
36. Cupola not designed properly.
37. Tuyeres are too small.
38. Helper fell in cupola.
39. Rotten luck.
40. Put in iron—slag came out.

right in its place, but as a steady diet it is not a success. The cupola may be compared to the human body which requires a mixed diet to supply the proteins and carby-hydrates, also the vitamins *A*, *B*, *C*, and what have you up your sleeve, you rascal you. An aperitif of wood at the beginning of the heat stirs up the old gastric juices and one thing and another, but as a steady stoking material, it simply isn't there. A possibility exists that a cheese paring policy forced the melter to cut his coke down day by day, until finally nothing was left but the wood. Faithful and loyal to the last he stoked her up with railroad ties, piled in the iron and then sat down and wept. A sad case.

"Helper fell in cupola. Regrettable of course, but those little accidents will happen. If the company does not want its helpers to fall in the cupola, it should provide a safety zone extending back at least 6 feet from the charging door. The men should be equipped with life lines, life buoys, gas masks and a short ladder strapped to the back, by which they could climb out again. Under the provisions of the NRA and in accordance with the policy of restricting the production of crops and live stock, it is possible that in future the melters will be instructed to push every second or third helper into the cupola. However, in the present instance the evidence seems to indicate that the helper fell in under his own power. Hence all objections are over ruled and the excuse must be accepted as legitimate.

"Cupola not designed properly. Any attempt to cast discredit on this standard excuse would disorganize the entire gray iron foundry industry. After every other excuse has been exhausted the melter has depended on this infallible clincher. If he had his way he would design a cupola that really would melt iron, but what can you expect from a stack too small or too large in diameter, too high or too low, too small or too large tuyeres and all the wrong size?

"Excuses," Bill concluded, "Always remind me of the tough bird who held up a prominent citizen and said, 'Hey, buddy, how about handing me over all your coin as a donation to the hospital you'll be sent to if you don't!' "

Suggests Standards For Apprentice Training

A joint committee of the American Foundrymen's association and the National Founders' association recently has suggested "Standards Covering Foundry Apprentice Training," which has been published in booklet form for distribution. The text discusses the problem of apprenticeship as it is related to the management, and presents suggestions on selection of apprentices, term of apprenticeship, schedule of advancement, related instruction, supervision, stabilization of employment and terms of indenture. Suggestions covering details of the apprentice program are included.

The American Foundrymen's association also has published the discussion "What the Government is Doing About Apprenticeship" by William F. Patterson, as presented at the recent Philadelphia convention. Both publications may be secured through the association headquarters at 222 West Adams street, Chicago.

In Service for Nearly Half a Century

A white bronze grave marker in an old cemetery in Pulaski, Ill. is shown in the accompanying illustration. It wa smade by the American White Bronze Co., Chicago, in 1888, and although it has been exposed to the elements for nearly half a century, apparently is in as good condition as when it was erected. Letters and ornamental features are as sharp and clear as when the castings left the sand. The metal is about $\frac{5}{8}$-inch thick, with the four sides made from one pattern and fitted accurately by mitered joints at the four corners. The panel on each side containing the inscription is a separate casting and bolted in place. The one piece vase on top, also is a separate casting.

The cast monument has been standing for nearly 50 years

An old deserted church building near the cemetery is fitted with cast iron window sills. Stone markers of the same or even of later date than the metal monument show deterioration to a considerable extent from the effects of time and weather. Considering the remarkable endurance records set up by metals it would seem that this particular field presents possibilities for extending the use of castings. Picture and data are presented through courtesy of Haydn Laycock, Frederic B. Stevens Inc., Peoria, Ill.

French Technical Group Elects Officers

French Foundry Technical association recently elected the following officers: President, Emile Ramas, professor at the Foundry high school; senior vice president, Maurice Werts, Les Fils de A. Werts; French vice presidents, Achille Brizon, managing director S. A. des Fonderies A. Brizon; Eugene Dady, president, Association Amicale et Mutuelle de Fonderie; Charles Koehler, secretary-general, French Foundry Employers' federation, and managing director, S. A. des Fonderies de St. Ouen; Jean Lobstein, managing director of the Usines Lobstein, president of the Paris Ironfounders' Employers' federation; Leon Montupet, managing director of the Fonderies Montupet; Henri Strube, engineer and ironfounder, president of the Bronze and Brass Founders' Employers' association.

Foreign vice presidents: Belgium—Joseph Leonard, president of the Belgian Foundry Technical association; Spain—Juan-Manual Espana, consulting engineer, honorary Spanish Commercial Attache in Paris; Italy—Federico Jarach, president of the National Fascist Federation of Industry and Metallurgy, Milan; Luxemburg—Leon Brasseur, Engineer.

Secretary-General: Roger R. Meyer, director of the Societe de Produits Metallurgiques; treasurer, Albert Lardin.

Brass, Bronze And Iron Alloys Listed

Cramp Brass & Iron Foundry Co., Paschall station, Philadelphia, has published a reference catalog on its brass, bronze and iron alloys for engineering purposes. The company has not attempted to cover all the nonferrous or ferrous alloys in their entirety, but has presented data on those alloys which are in constant demand and which, in the opinion of the management, constitute the basis of the variations that have resulted to suit individual requirements.

Information is presented on the composition and the physical properties of a wide range of alloys, while reproductions of photographs show types of castings produced from those alloys. The Clamp Brass & Iron Foundry Co. operates a cupola foundry, an electric furnace iron foundry, a large brass shop and a small brass shop. The company also has a large pattern shop.

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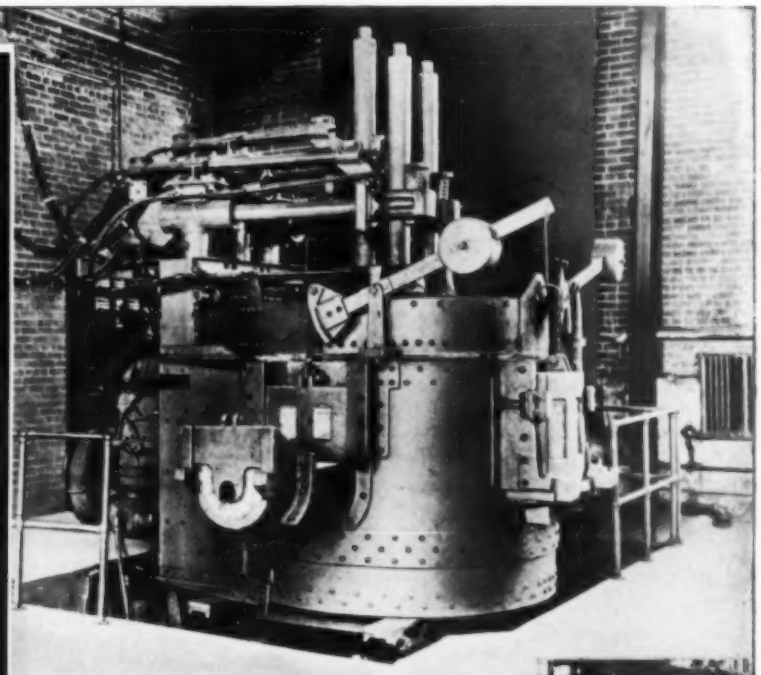

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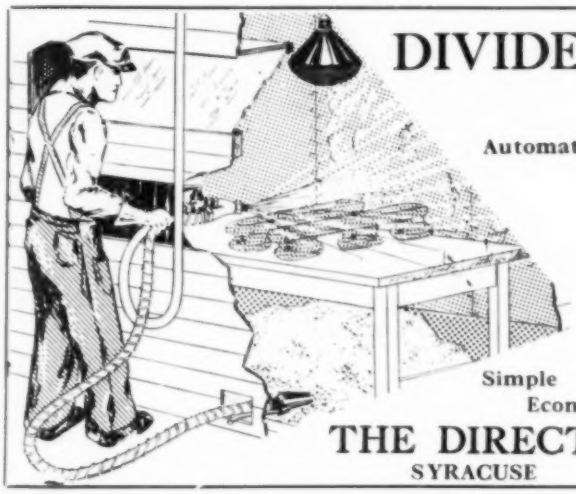

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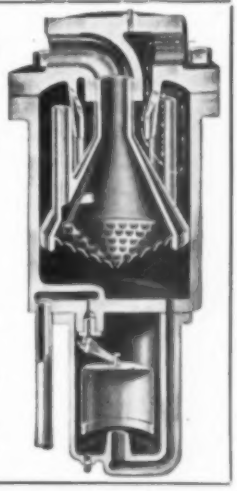

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Gray Cast Iron—*Chapter II*

(*Concluded from page* 23)

cementite, or metastable system. The salient features readily become apparent on inspection of the diagram. Above the line *BC* the metal is completely liquid, while below the line *IEC* it is completely solid. Starting at the melting point of pure iron, the points of initial solidification drop as the carbon increases, up to 4.3 per cent carbon. Beyond that point further increase in carbon results in increase in temperature for the points of initial solidification. It will be of interest to consider what takes place in three irons, containing respectively 3 per cent, 4.3 per cent and 5 per cent carbon.

With the 3 per cent carbon iron the metal is completely molten or liquid above about 2426 degrees Fahr. (1330 degrees Cent.) When the metal passes just below that point, saturated austenite, that is gamma iron saturated with carbon, assuming time for diffusion is obtained, separates. As the temperature drops further, more saturated austenite separates out, and the concentration of carbon in the remaining liquid therefore increases. That action continues until the line *EC* is reached. Just above that point the concentration of carbon in the remaining liquid has increased to 4.3 per cent, corresponding to the cementite-austenite eutectic. That eutectic, called ledeburite, solidifies on passing through *EC*.

It has been shown how saturated austenite separates out from below *BC* until the final formation and solidification of the eutectic on passing through *EC*. According to the metastable diagram, as the temperature is lowered below the eutectic, about 2100 degrees Fahr., some of the eutectic cementite is decomposed under certain conditions, graphite formation commencing. Also the solubility of carbon in the saturated austenite diminishes with drop in temperature, resulting in the formation of pro-eutectoid cementite, which in turn may break down into graphite and austenite. That limit of solubility is indicated by the line *SE*.

The alloy of eutectic composition, 4.3 per cent carbon, solidifies on passing through the eutectic *E* at 2100 degrees Fahr., the austenite-cementite eutectic, ledeburite being formed.

An alloy containing 5.0 per cent carbon commences to solidify at about 2525 degrees Fahr., hyper-eutectic cementite separating until the eutectic concentration of austenite and the carbide cementite, at 4.3 per cent carbon, is reached and ledeburite separates. The cementite separating above the eutectic concentration is known as hypereutectic or primary cementite. It separates as coarse plates which ordinarily break down readily into austenite and coarse flakes of graphite.

The changes that may take place on cooling from the melt are shown nicely in diagrammatic form by Sauveur, Fig. 45. In the straight iron carbon alloys those containing less than 4.3 per cent carbon are called hypoeutectic. Above the pearlite transformation, line *DF* on the diagram by Sauveur, hypoeutectic irons are composed of:

1—Saturated austenite
   (a) Plus proeutectoid cementite rejected from the saturated austenite below the eutectic solidification temperature.
2—The eutectic ledeburite, composed of saturated austenite and eutectic cementite. The saturated austenite of the eutectic deposits additional cementite, proeutectoid, as the temperature falls.
3—Under certain conditions the forms of cementite, eutectic and proeutectoid, and the saturated austenite may be converted largely into graphite and iron on cooling from the eutectic solidification temperature to below the eutectoid temperature or the saturated austenite may be converted into pearlite, the structure then consisting of pearlite and graphite.

The alloy containing 4.3 per cent carbon is the eutectic alloy and is so-called. It solidifies at constant temperature, 2100 degrees Fahr., and, according to the iron-cementite or metastable system, consists wholly of the eutectic ledeburite. The saturated austenite of the eutectic necessarily rejects part of its dissolved carbon, as proeutectoid cementite as the temperature drops. Both cementite and saturated austenite may be changed to graphite and iron wholly or in part as the cooling proceeds to and below the eutectoid.

Alloys above 4.3 per cent carbon are termed hypereutectic. Cementite, termed hypereutectic or primary cementite, separates along the line *EL'* down to *ES'*, of the Sauveur diagram, Fig. 45, at which point the balance of the alloy now of eutectic composition solidifies.

According to the metastable diagram at the point of eutectic solidification the hypereutectic alloy consists of:

1—Hypereutectic cementite.
2—Ledeburite — saturated austenite and eutectic cementite. On cooling there is rejection of proeutectoid cementite. Under certain conditions the cementite and saturated austenite finally may be broken down largely into graphite and irons.

Microstructure of a hypereutectic white iron has been shown in Fig. 12. Note the dark primary dendrites originally of austenite, which have changed to pearlite on passing through the austenite-pearlite transformation range, surrounded by white cementite areas.

Microstructure of an approximately eutectic iron is shown in Fig. 43. The cellular type structure is found in many eutectic irons. In the present case, the white portion consists of cementite, the dark is made up of saturated austenite largely, or the pearlite resulting therefrom, the two in constant ratio, carbon 4.3 per cent making up the eutectic called ledeburite.

The hypereutectic white iron shown in Fig. 44, is made up of angular plates of hypereutectic cementite and the eutectic ledeburite.

Some may wonder concerning this preliminary discussion of the metastable iron-iron carbide system, or the white iron system, when this series deals with a study of gray iron—gray iron which by definition contains no cementite aside from that in the eutectoid pearlite. May we not point out that the straight iron-carbon alloys in the higher carbon ranges and in absence of silicon and certain other constitutents usually form white irons unless cooled slowly. By considering the straight iron-carbon white iron series first, then dealing with the more complex iron-carbon-silicon alloys later, the problems are simplified considerably. Second, there appear certain relationships between the cementitic formations discussed previously, and the general distribution of certain graphite formations. Third, when certain irons, which on *normal* cooling would be gray, are chilled rapidly, they ordinarily contain eutectic and proeutectoid cementite, indicating that in many cases the nature of the iron-white or gray- depends on the rate of cooling through certain temperature ranges.

The author wishes to acknowledge the thorough review and helpful comments of Dr. Lorig and Mr. Epstein, Battelle Memorial Institute, Columbus, O., on the chapters of "Gray Cast Iron" covering structural metallurgy and those dealing with the elements carbon, silicon, manganese and sulphur.

Broadway Mfg. Co., Knoxville, Tenn., has been made agent in the Knoxville area for the General Refractories Co., Philadelphia, Shadbolt & Boyd Co., Milwaukee, Wis., will represent the General company in the Milwaukee area.

ADVERTISING PAGES REMOVED

What Will Follow NRA?

(*Continued from page 25*)

report of industry having taken up some of the burden is clearly evident from letters received after the Supreme Court decision.

Philip Van Duyne, Meeker Foundry Co., Newark, says:

> As foundrymen we should all realize that the problem of unemployment is still more important than the problem of price control; that the economic law of supply and demand (even in respect to labor as a commodity) and the Federal anti-trust laws now have greater force and effect than during the last two years. Therefore, we should endeavor to work out our own problems without reliance on Federal support, and with knowledge that man-hour production must be increased, that wages of unskilled labor must respond to the oversupply and that both costs and prices will decrease. Certainly the experiences of the last two years have taught castings manufacturers that no one gains from competition based on prices below cost.

A new England manufacturer of gray iron castings states that in his region few shops are now working up to the code minimum of 40 hours and he doubts if the question of daily or weekly hours will be seriously affected. Furthermore wages have continued substantially above the code minimum as regards both common labor and the higher brackets.

E. E. Griest, Chicago Railway Equipment Co., and for several years president of Malleable Iron Research institute, points out that the actual direct labor costs of malleable castings represent fully half the selling price and that therefore some uniformity in relation to labor rates is necessary to a stabilized market. He says:

> I have great confidence in the sound judgment of the majority of members of the malleable industry and I feel that most executives appreciate the benefits which have come to them through the operation of the code. I am sure that some members have had proved to them that reasonable hours have resulted in much greater efficiency. It was realized that prices should be higher but efforts have been made by producers to improve efficiency, reduce costs, pay reasonable rates for labor and then gradually build up the price structure so that management may get a proper return.

Charles Wegelin, Dixie Bronze Co., Birmingham, Ala., notes an improvement in business under NRA and comments upon the benefits to working men and indirectly to consumer businesses. He hopes to see wages maintained commensurate with the business a firm does. However, he believes that hours should be governed by local conditions as well as by the amount of business done.

Some handicaps encountered by the 40 hour week in the foundry industry were expressed, according to George M. Morrow, Goslin-Birmingham Mfg. Co., Inc., Birmingham. However, he states that it is the intention in that region to make no reduction in wages or in code hours. He says:

> We believe that if all industry will take the same stand, that NRA will soon be forgotten and that actual recovery will be effected. We believe that what is needed at this time is for everyone to hold fast to what they have and not attempt to make any changes whatsoever.

A steel foundryman in the East is not as hopeful. While he believes implicitly in the retention of wage and hour conditions, he doubts whether it is possible to attain this result. "Men will not do things without law that they oppose under law, and therefore I feel that little will be gained in that direction unless the characteristics of some men have changed very much."

In the foundry industry in general, code provisions exercised but small influence upon prices. An open price filing system obtained by the steel foundry association under its early code perhaps was the most effective in stabilizing prices slightly above the actual costs. This plan did not in any way constitute price fixing, but the value in stabilization was noteworthy. The Malleable Foundries association had a recognized fair and reasonable cost tabulation which had some influence but did not operate in raising prices which in many instances were too low. The gray iron foundry association had a basic cost system and a loose code provision prohibited selling below cost. The nonferrous foundry association was denied even a recognized standard cost system.

The consensus of opinion is that trade associations should recognize some wage and hour standards, should take action toward the maintaining of fair price levels for castings. But this under present conditions will be largely dependent upon the resolution of each individual to abstain from selling below cost.

One nonferrous foundryman, who prefers not to be identified, proposes a program of five points to conserve that small amount of benefit which he felt the NRA provided. His program of five points is as follows:

1. Abolish the NRA bureaus.
2. Enact a federal law abolishing child labor.
3. Enact a federal law establishing reasonable and regional minimum wages.
4. Enact a federal law, establishing reasonable maximum hours, and I would suggest they be modeled along the Michigan law.
5. Allow and encourage trade associations, with a view not to price fixing, but to the prevention of wild, unreasonable price wars through the exercise of group pressure and education, upon the unenlightened people who are likely to discount them.

The destructive influence of antiquated anti-trust laws is mentioned in several letters. One steel foundryman says:

> You, as well as I, are acquainted with the experiences of the past and I look for little change under present circumstances, or voluntary codes, unless by mutual agreement some penalty or fine can be imposed upon those who break its provisions. Such an arrangement might be possible provided the right spirit of co-operation still exists among the large majority of the men of the industry. An immediate modification of the Sherman anti-trust law that would allow such co-operative action as would tend to stabilize prices would be extremely helpful. Of course, such modification should provide for a control that would make it impossible for exploiters to raise prices to too high a level for chiselers to cut them to a destructive level.

Referring to aluminum permanent mold castings E. G. Fahlman, the Permold Co., Cleveland, states:

> This industry has never had any price fixing under the code, with the result that prices all have been made on a competitive basis, and under those circumstances, the existence or absence of a code for the industry, I do not believe, will matter much as far as price structure for this type of a product is concerned. This industry did have some other abuses which were covered by the fair practice provisions of the code. However, there has never been an occasion since the code became effective for citation of any member of the industry for violation of these fair trade practices, and it is my opinion that among the members of this industry it is solely a question of their education as to the result of abuses in order to rectify the conditions covered by the fair trade practices. Under those circumstances, I doubt very much whether the absence of the code is going to cause a recurrence of these abuses.

The recognized opinion of manufacturers in general is that anti-trust laws created under a popular hysteria, similar in many phases to the launching of NRA, have remained as an incubus on business and have in no way benefited the mythical and non-existent class defined as the consumer. Along this

line E. L. Brooke, the Sawbrooke Steel Castings Co., Lockland, Ohio says:

> As for the future, I would like to see new Codes practically identical with the former ones—*where they have worked*—adopted voluntarily by various industries under a suspension of the anti-trust laws, with the consumer having recourse to the courts in any cases of flagrant overcharging supported by combinations. It is my opinion that the anti-trust laws are about as useful today as the Connecticut blue laws—they both belong to eras which have long been dead. With our capacity to produce in all lines and the tendency to cut and chisel so manifest through the last 20 years, we as consumers need not fear any gouging by manufacturers. If there be such danger in a very few industries in which there may be only half a dozen competitors in the United States they might agree to government supervision of their prices, but in over 90 per cent of our commerce competition will take care of the so-called public—the ones who require protection are the business men. Protection from each other, it is true, but experience has shown the need of it.

In summarizing his opinion on NRA and what will follow Walter S. Seelbach Forest City Foundry Co., Cleveland deprecates any attempt at price control. While some benefit was noted through an approach to uniform trade practices, he believes that supply and demand is and always will continue to be the dominate influence in selling castings.

Obituary

SIDNEY KENT BECKER, 51, manager, Fairfield plant of the United States Aluminum Co. and associated with the metal industry for the past 29 years, died at Bridgeport, Conn., May 14. Born in Buffalo, N. Y., in 1884, Mr. Becker received his early schooling in that city. He later attended Harvard university, graduating in 1906 with the degree of B. S. in mechanical engineering. Following his graduation, he worked for 2 years with the Lackawanna Steel Co., Lackawanna, N. Y., and later became chief inspector of the Subaqueous division, Detroit River tunnel.

In 1910, Mr. Becker became manager of the Fairfield plant of the Aluminum Castings Co., which position he held until 1914. For the next 2 years, he was associated with the Locomobile Co. of America, and from 1916 to 1919, he was secretary and treasurer of the Standard Oil Engine Co. In 1919, he returned to Fairfield as manager of the plant of the Aluminum Castings Co. When that plant became part of The United States Aluminum Co. in 1922, Mr. Becker was retained as manager, in which capacity he served until the time of his death.

When the new Fairfield plant was built in 1928, Mr. Becker largely was responsible for its construction along colonial lines. The red brick office building and foundry, which harmonize with their setting on the historic Boston Post road, are unusually attractive.

Sidney K. Becker

Mr. Becker was an alternate director from the New England District for the Nonferrous Foundry Association.

♦ ♦ ♦

Madison T. Davis Jr., president and founder, Kanawha Mfg. Co., Charleston, W. Va., died May 15.

♦ ♦ ♦

David B. Davies, head of the Davies-Goebig Mineral Supply Co., Chicago, brokers of foundry sand and mineral supplies, died May 14.

♦ ♦ ♦

William H Smith, president and general manager, the Pioneer Alloy Products Co., Cleveland, died June 3. Mr. Smith was a pioneer in the alloy castings industry.

♦ ♦ ♦

Bernhardt F. Mueller, 34, vice president and treasurer, Mueller Brass Co., Port Huron, Mich., died May 22 from injuries sustained in an automobile accident. Gordon Godley, assistant sales manager, was killed instantly.

♦ ♦ ♦

Maurice I. Johnson, 58, for many years treasurer and lately vice president of Gisholt Machine Co., Madison, Wis., died suddenly at his home on May 13. He was the youngest of the four brothers for whom their father, John A. Johnson, founded the Gisholt Co. in 1887. Of these, Hobart S. Johnson, president of the company, survives him; the two older brothers, Frederick A. and Carl A. having died previously. Mr. Johnson received his education at the University of Wisconsin and West Point Military academy. Aside from his duties as an officer of the company, he gave most of his attention to the management of the Gisholt foundry.

♦ ♦ ♦

George H. Kramer, 76, president, Kramer Brothers Foundry Co., Dayton, O., died recently at his home. Mr. Kramer was born in Dayton, and was a life-long resident of that city, having worked as a molder there and later operated a hardware store before founding the Kramer Brothers Foundry in 1893. He had been president and general manager of the foundry since its organization.

♦ ♦ ♦

Mr. Paul Labbe, president of Societe des Acieries de Longwy, died in Paris as the result of an accident on May 14, 1935. Mr. Labbe was a member of the directing committee of the Comite des Forges de France, president of Societe Francaise Metallurgique (Procedes Griffin), a director of Societe Louvroil et Recquignies, tube manufacturers, president of Societe de Moutiers, an iron-ore mining company, a director of Ateliers de Construction du Norde de la France et des Mureaux, and vice-president of Societe des Mines de Valleroy. In 1933 Mr. Labbe was appointed president of Acieries de Longwy, one of the most important French iron and steel concerns.

♦ ♦ ♦

Alfred E. Hammer, 77, president, treasurer and general manager of the Malleable Iron Fittings Co., Branford, Conn., died May 9. Mr. Hammer was a pioneer in the malleable iron castings industry and his experiments in that field contributed to its present progress. Shortly after finishing a preparatory course for entry to the Sheffield Scientific school of Yale university, New Haven, Conn., he entered a laboratory specializing in metallurgical and chemical engineering under the direction of Prof. Eggerts, Upsala university, Sweden. After graduation, he entered the employ of the Malleable Iron Fittings Co., Branford, his father being one of its founders. In 1875 he helped establish what probably was the first laboratory in connection with the malleable iron industry, his experiments resulting in the establishment of a definite ratio between the elements and particularly between the manganese and sulphur in black heart malleable. Mr. Hammer at

(*Concluded on page* 84)

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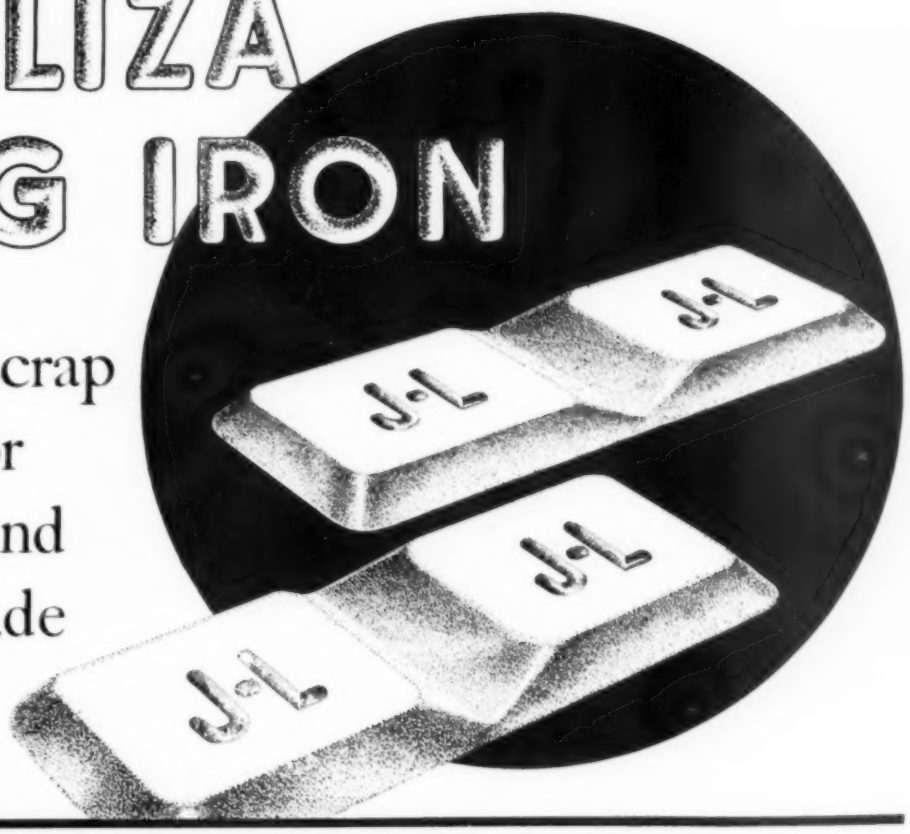

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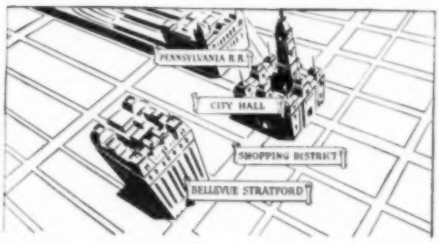

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tended the first meeting of the American Foundrymen's association held in Philadelphia, May, 1896.

• • •

C. A. Stockstrom, 83, chairman of the board, American Stove Co., St. Louis, Mo., whose death was reported in the May issue of THE FOUNDRY, was a pioneer stove manufacturer. With his brother Louis, he founded the Quick Meal Stove Co. in 1881. A number of years after the founding of that company, the Stockstrom brothers began the manufacture of stoves to burn gas instead of gasoline. In 1902 they organized the American Stove Co. which consolidated the Quick Meal Co. and eight other stove manufacturing companies in St. Louis and other cities. Mr. Stockstrom was president of the consolidated companies until 1927, when he became board chairman, his brother becoming president.

• • •

Henry F. Wanning, director and member of the executive committee, Farrel-Brimingham Co., Ansonia, Conn., died April 28. Mr. Wanning was born in Webster, Mass. in 1846. He entered the industry at an early age and then secured work with the New York Steel Co. In 1865 he went to Derby, Conn., then Birmingham and became connected with the Birmingham Iron Foundry as bookkeeper. He then successively became secretary, treasurer, vice president and in 1891 was elected president, remaining in that position for 37 years. In 1927, when the company was merged with the Farrel Foundry & Machine Co., Ansonia, Mr. Wanning was made a member and director of the executive committee.

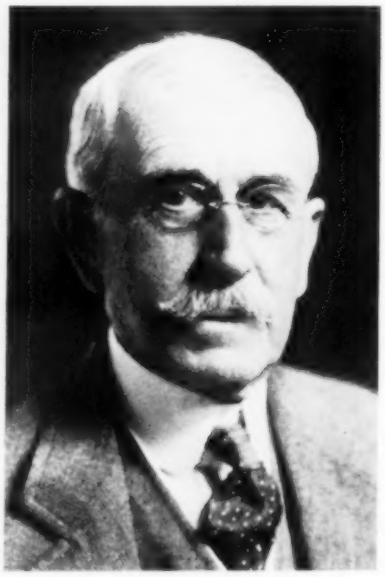
The Birmingham Iron Foundry was established in 1836 and was incorporated in 1850. It was one of the country's pioneers in the manufacture of chilled iron rolls, and at one time when the flour mills were changing from the old mill stones to chilled rolls, a large part of the business of that company was in the manufacture of "wheat" rolls and complete flour mills. The foundry also built special machinery for many purposes.

Belgian Founders Plan Foundry Congress

An international foundry congress, organized by the Belgian Foundry Technical association, will be held in Brussels, Sept. 20 to 25. The meeting coincides with the International and Universal Brussels exposition which should attract a large number of visitors.

The congress will include technical sessions, plant visitations, receptions, and various ceremonies, and will be completed by sight seeing trips.

The technical program will feature sessions on steel castings, gray iron, malleable castings, and nonferrous castings. Possibilities of the use of electricity in the foundry also will be studied. Secretary- general of the congress is located at 57 Rue de L'Academie, Liege, Belgium.



Henry F. Wanning

Book Review

The Book of Stainless Steel, edited by Ernest E. Thum, 787 pages, published by the American Society for Metals, Cleveland, and supplied by THE FOUNDRY, Cleveland, for $5.00 plus 15 cents postage and in Europe by the Penton Publishing Co. Ltd., London.

So much progress has been made in the development and application of stainless steel during the past two years that much of this, the second edition, represents new material. Twenty-seven chapters have been rewritten, and 168 pages of text have been added to this revised work.

While the preponderance of data presented deals primarily with rolled products, considerable attention is given to foundry practice and the properties and applications of cast alloys. The section on foundry practice was prepared by R. D. Alger, superintendent, and G. C. McCormick, vice president, General Alloys Co., Boston. Under properties of typical alloys, A. C. Jones, research engineer, Lebanon Steel Foundry, Lebanon, Pa., has discussed castings of 5 per cent chromium steel, low carbon stainless steels, chromium ferrites, 20 to 30 per cent chromium-iron alloys. In addition, part of the data presented on specialized tests and requirements of consuming industries, of course applies to cast products.

Undoubtedly, those interested in any phase of the subject of stainless steel, will find this text exceedingly valuable.

Publishes Analysis Of Costs and Profits

National Industrial Conference Board, Inc., 247 Park avenue, New York, has published a preliminary analysis of costs and profits in manufacture in the period from 1914-1933. This traces the distribution of manufacturer's receipts from the sale of goods among various items of costs and profits. Facts are presented without expression of opinion or analysis of trends, but are interesting as basic information in the study of questions of public policy, taxes, etc.

This publication is for sale by the sponsor organization at the price of $1.

Directory Gives Data On Ship Building Yards

Many changes are listed in the 1935 *Great Lakes Red Book* just published This vest pocket directory of vessels, owners, operators, captains and engineers is in its thirty-second annual edition, published by *Marine Review*, Cleveland, under the direction of A. H. Jansson, editor.

In addition to names of more than 1500 vessels registered on the Great Lakes, with information about owners, operators, captains and engineers, the *Red Book* contains a complete directory of ship building yards with executive personnel and other pertinent information.

Guild Elects Officers

Second technical meeting of the Electric Metal Makers guild was held at the Hotel Pritchard, Huntington, W. Va., recently with A. E. Kayes, International Nickel Co., Huntington, and president of the guild, presiding.

The following officers were elected: R. S. Read, Holcomb Steel Co., Syracuse, N. Y., president; Joseph A. Scott, Driver-Harris Co., Harrison, N. J., vice president; and J. H. Chivers, Park Works, Crucible Steel Co. of America, Pittsburgh, secretary-treasurer.

Moves Offices

Sullivan Machinery Co. has moved its general offices from 400 North Michigan avenue, Chicago, to the Bell building, 307 North Michigan avenue.

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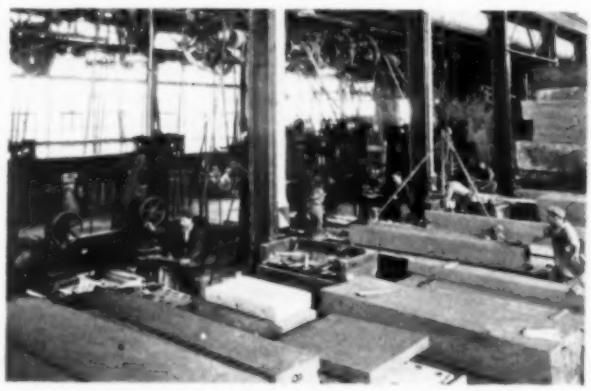

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Steel Rolls

(Las Cylindres de Laminoirs en Acier Coule—Leur Fabrication—Leurs Defauts) Cast Steel Rolls—Their Manufacture—Their Defects, by M. L. Quincy (second installment). *Revue de Metallurgie*. Paris, February, 1935.

In the first installment of this article (THE FOUNDRY, May, page 56) the author dealt mostly with piping. In the present installment the author first covers heterogeneity, due to differences of chemical composition which occur in the cooling metal between the top and the bottom of a roll, and also from the center to the periphery. These differences are explained partly by differences of density during the cooling process, partly by segregation. It is stated that heterogeneity in itself is not a cause of rejection; in fact, as regards transverse heterogeneity, it causes the metal to become harder as machining proceeds toward the center of the roll.

In the course of machining a roll, black lines usually appear on the surface. These are stated to be due to porosities which become filled up with the residues of segregation. They contain sulphur, phosphorus, and they are rich in carbon. These lines are harder than the neighboring parts of the rolls. These defects are much feared by roll manufacturers, because it may often happen that they will show when machining the grooves. The best way to avoid these defects is to exert a thorough control of the metal and its pouring, especially as regards the addition of deoxidizers. Another way is to cast the rough roll with an extra thickness of about 200 millimeters where the grooves are to be cut, but this is rather costly.

It sometimes happens that a heavy roll breaks, or fails, before it has accomplished its normal time of service. When this occurs, one finds that the section of breakage shows three zones: A central zone with large grains of crystallization; an intermediate zone with smaller grains, and containing cavities, and an outside zone, normally crystallized, but with cavities over the whole surface. The author explains a theory showing that this defect occurs during the cooling of the roll. When the outside of the roll is solidified, the metal inside is still in a molten state, and a long time elapses before the center begins to solidify; it reaches a state similar to the state of surfusion. It then suddenly starts to solidify, and contraction may be impeded by the formation of a roof at the upper part, and a weak zone occurs in that section. This is a grave defect, especially if it occurs in the plane of a groove. Rolls with a high carbon content are more prone to this defect than others. It is stated that there is no certain way of avoiding it.

In conclusion, certain defects such as blowholes, scabs, can be eliminated by normal precautions and good control. Piping can be reduced, but not completely removed, by a proper feeding head, especially if it is kept hot. There is as yet no sure method of avoiding segregation lines or rupture due to certain phenomena of contraction in the heavier rolls.

Nitriding Iron

Local Hardening of Cast-Iron and Nitriding (Le Durcissement Local des Fontes et al Nitruration), by Leon Guillet and Marcel Ballay. *La Fonte*, bulletin of the French Center of Foundry Research, Paris, January—March, 1935.

The article begins with a brief review of the methods used for hardening cast-iron by heat-treating. The nitriding process, discovered in Germany by Fry and first applied to steel, consists in placing the pieces, after they have been machined, in cases through which a current of ammonia passes during 50 to 70 hours, the cases being heated to a temperature of 500-510 degrees Cent.

This process can be applied to cast-iron having a suitable chemical composition and a suitable structure, otherwise the hardened surface becomes brittle and tends to scale off, especially where large graphite flakes constitute a weak spot. Such a tendency to brittleness will be indicated by the ragged edges of the depression left by a Vickers' diamond pyramid hardness tester.

Commercially, nitriding has been applied to iron cast centrifugally, more especially to irons containing 0.5 manganese, 1.40 to 1.60 chromium and 0.70 to 1.0 per cent aluminum. Before being machined, the parts are subjected to graphitization treatment at 925 degrees Cent, followed by drawing at 275/300 degrees. The parts are machined and then hardened by the nitriding process in electric ovens at 525 degrees during 65 hours. This method is employed for cylinder sleeves, hydraulic distributors and other parts that must resist wear and can be centrifugally cast. Brinell hardness on the surface ranges from 825 to 880 and can attain 900. Any areas that must remain soft are protected by a coating of tin or of a lead-tin alloy.

The extension of this method of surface hardening to ordinary sand-cast pieces is being studied in the laboratory. It is necessary to obtain the graphite in fine grains, and three processes appear to be promising of results: (a) low-carbon irons (Carbon 1.99, silicon 4.42, manganese 0.60, chromium 2 22, molybdenum 0.28) heat-treated at 975 and 800 degrees, then nitrided at 525 degrees during 65 hours; (b) white or mottled irons with carbon about 2.5 per cent, silicon 2.4, manganese 0.60, chromium 1.30, aluminum 0.80, can be given the same treatment as (a); (c) pieces to be cast with chills placed where the metal is to be hardened. The parts are subjected to a graphitization treatment, followed by nitriding: this method appears to give interesting results.

Research Papers Cover Testing Methods

U. S. department of commerce, national bureau of standards, recently has published research paper RP 768 on "Methods of Testing Thermocouples and Thermocouple Materials," by William F. Roeser and H. T. Wensel. The department also has published research paper RP 767 on "Standard Tables for Chromel-Alumel Thermocouples," by William F. Roeser, A. I Dahl, and G. J. Gowens.

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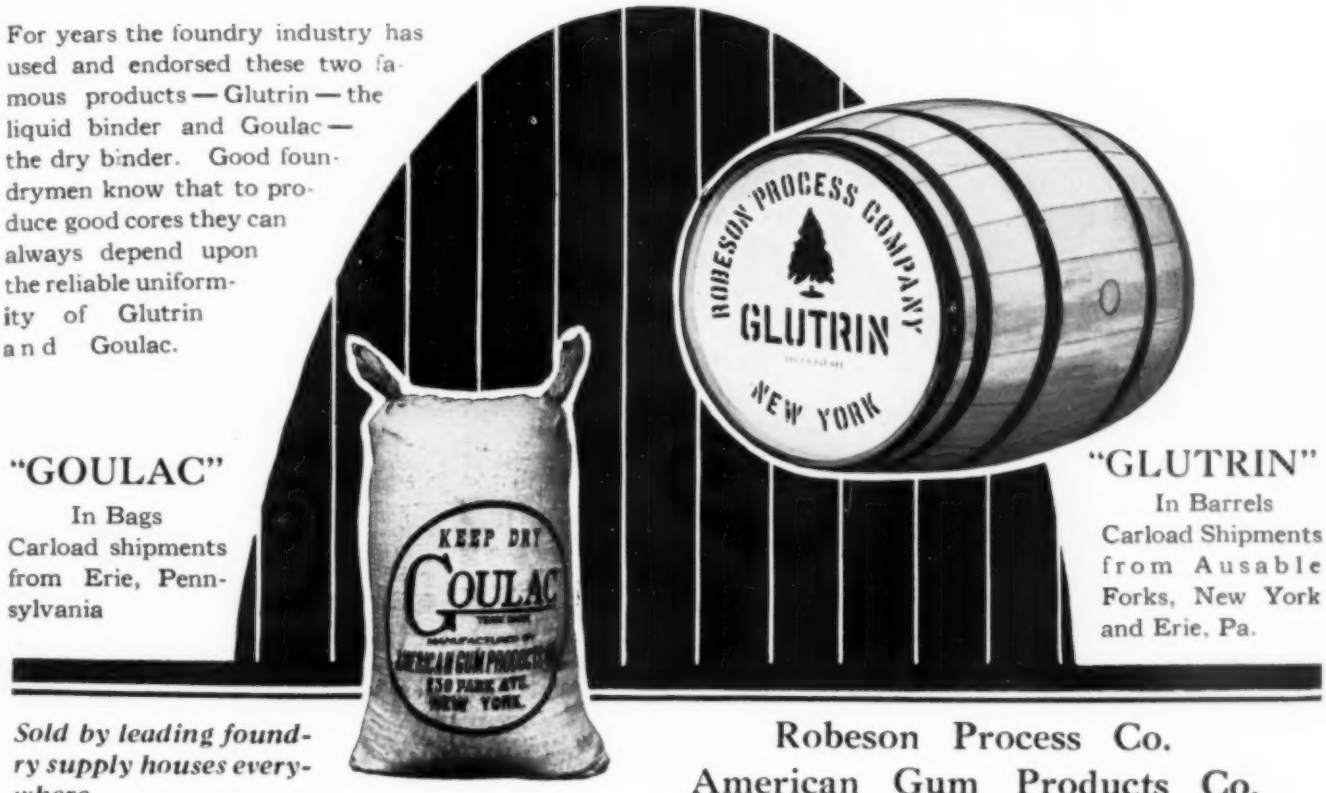

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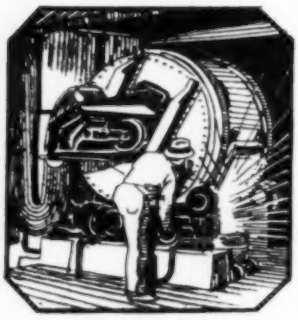


For Foundries

Magnetic Disk Brake Made in Five Sizes

Magnetic Mfg. Co., Milwaukee, has introduced a new magnetic disk brake which can be made for floor or motor mounting. It can be supplied for either alternating current or direct current operation, preferably the former. Five sizes now are being produced, ranging from 10 to 90 foot

The magnetic brake can be supplied for alternating or direct current

pounds torque for continuous duty operation.

Features of design include symmetrical outline of the unit, as well as simplicity in both design and construction, with minimum number of moving parts. Other features include manual release, lining wear indicator, constant torque provided and not subject to variation from lining wear, simple and practical adjustment for torque and lining wear, and easy replacement of linings when necessary.

Shapes Cast from Refractory Concrete

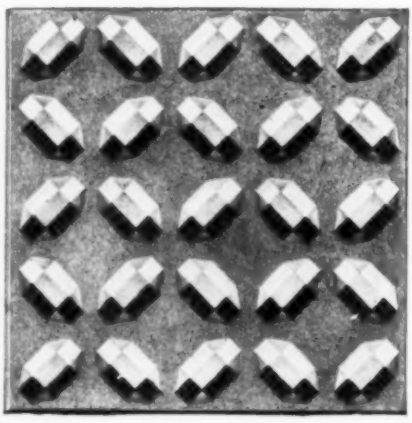
Johns-Manville, New York, has introduced a new type of firecrete for casting light weight refractory concrete on the job. The new product is composed chiefly of high alumina clay calcined at high temperature. The resulting concrete weighs only 75 pounds per cubic foot. Under continous operation at 2400 degrees Fahr., shrinkage is claimed to be so slight as to be negligible. It is also claimed that the material has withstood alternating heating and cooling tests without spalling. The material is recommended for casting light weight refractory shapes and for furnace doors and floors.

Tapered Drum Features Balancer

Independent Pneumatic Tool Co., 600 West Jackson boulevard, Chicago, has introduced a line of balancers in capacities up to and including 200 pounds. A tapered drum of special design is featured throughout the entire line, and provides perfect balance of the load at any point within the range of travel. Four sizes in this line of balancers are equipped with locking and unloading devices.

Floor Plate Has Flattened Lug Surfaces

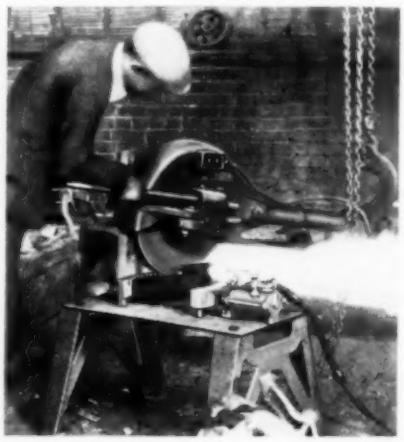
Illinois Steel Co., 208 South LaSalle street, Chicago, recently has introduced a new floor plate. The design, shown in the accompanying illustration, has been developed to provide a high degree of skid resistance from every angle. Other features of this new plate are its comfort under foot, as all lugs have a flattened top surface. The plates may be cleaned readily and drained freely. A wide range of standard weights and sizes is available.



The design has been developed to provide a high degree of skid resistance

Holds Castings for Grinding and Chipping

A snagging grip developed by the Sullivan Machinery Co., Chicago, is shown in the accompanying illustration. This consists of a base plate, with legs optional, and has an ad-



The unit clamps any shape of casting from 2 to 20 inches

justable back stop and an air-operated jaw. The unit clamps practically any shape of casting from 2-inches to 20 inches. It opens instantly to release the piece, but closes slowly, safeguarding the operator's fingers. The dog and jaw may be faced with wood to protect the surfaces of the softer metals.

The device is used to hold the casting for grinding and chipping and permits the use of swing frame grinders. The overall height of the complete unit is 23½ inches, the spread of jaw, 7¾-inches, and the weight complete 150 pounds.

Builds New Motor

General Electric Co., Schenectady, N.Y., has introduced a new type of electric motor which utilizes a stationary commutator and has the characteristics of a series-type direct current machine, which operates on alternating current power source.

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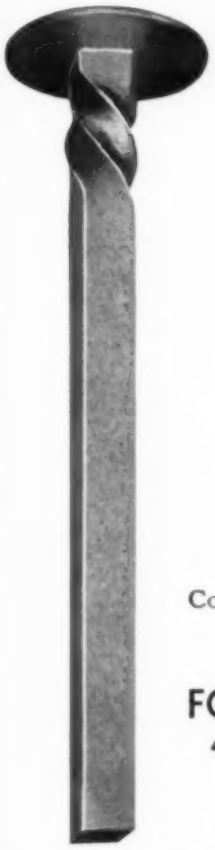

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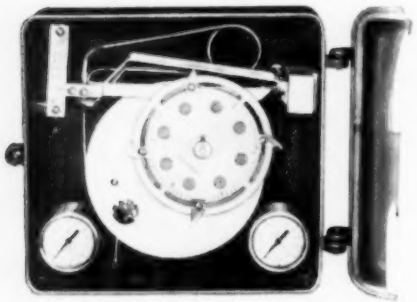
Controls Intermittent Valve Operation

Taylor Instrument Companies, Rochester, N. Y., have introduced a new control instrument for automatic, intermittent operation of diaphragm valves or other diaphragm-operated devices. The unit is limited to the repetition of a single operation. A view of the working parts of the device is shown in the accompanying illustration.

The unit has a circular cam on



Operations are controlled by a rotating circular cam carrying actuating lugs

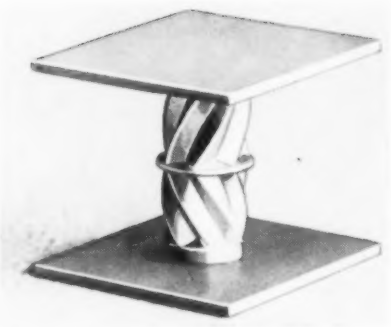
which the proper number of actuating lugs may be placed. The number of lugs correspond to the number of operations to be performed during the rotation of the cam. As many as 20 such lugs may be used. The duration of each operation is adjusted by moving the bracket carrying the nozzle so that its scribe mark is opposite the desired time interval on the scale. The actuating cam is driven by a spring clock, available for 1-hour, 6-hour, 12-hour, or 24-hour periods of rotation. Electrically driven clocks with identical periods of rotation also can be supplied.

A waterproof, non-corrosive aluminum case is provided to house the working parts.

Loader Features Tank Type Chassis Frame

Barber-Greene Co., Aurora, Ill., has introduced a new loader featuring a tank-type chassis frame. Synchronized feeding is secured through a special arrangement of the spiral feeding screws, thus increasing the capacity.

A new parallelogram axle is employed to keep the two crawlers parallel. The unit includes a special floating boom principle, which lets the crowding thrust go direct from the crawlers to the feeding end, and not through the main frame. A special automatic overload release sprocket protects the machine from overload. A view of the machine is shown at the right.



The shank of the chaplet has spiral serrations divided by a narrow strip

Spiral Notches Cut on Chaplet Stem

Angell Nail & Chaplet Co., 4580 East Seventy-first street, Cleveland, has introduced a chaplet as shown in the accompanying illustration. The shank of the chaplet is cut with deep spiral serrations from either end toward the center where they are divided by a narrow strip of metal of slightly wider diameter than the shank. These serrations, it is claimed, make it impossible for the chaplet to turn in the castings, while the center provides a seal against pressure of liquids and gases. It is claimed that a special metal is used in the chaplet which blends and fuses well with the casting. The chaplets are made with round and square heads.

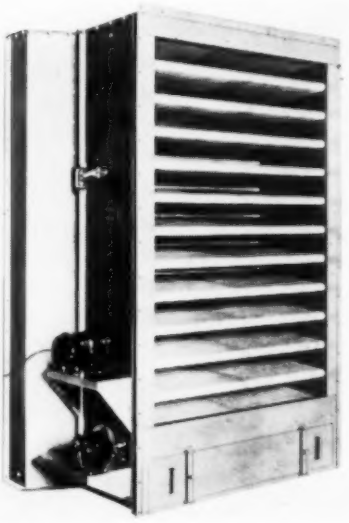
Indicates Dead Fuses

Littelfuse Laboratories, 4507 Ravenswood avenue, Chicago, recently has introduced a device called a Ded-Fuse Tattelite. This consists of a tiny neon lamp and casing, designed to tell instantly when and where a fuse is blown. The bulb itself is the size of a lead pencil tip 1-inch long.

Synchronized feeding is secured through a special arrangement of screws

Dust Filter Is Cleaned Automatically

Coppus Engineering Corp., Worcester, Mass., has introduced a new fully-automatic self cleaning, dry type filter. The unit uses a specialiy woven cotton fabric as the filter medium. When the air passes through this material, the dust particles are sifted out and deposited on the filter curtain.



Filter elements run in a zig-zag fashion in the shape of an endless belt

Periodically, according to dust concentration, the filter is cleaned by being moved over a dust drawer and a rotary beater set in operation. This may be accomplished manually or automatically, as desired.

Soft leather fringes beat the curtain on the clean air side, shaking the dust off into a dust drawer at the bottom. A complete cleaning cycle lasts from 8 to 15 minutes, according to the height of the filter.

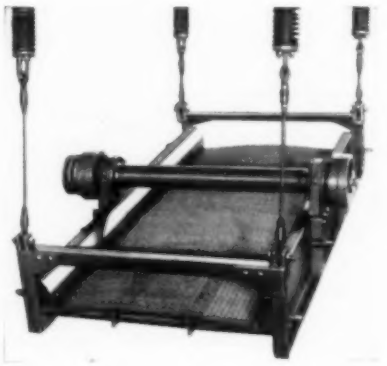
Filter elements run in a zig-zag fashion in the shape of an endless belt, over rolls, thus forming horizontal tapered pockets. Both edges of the filter curtain are reinforced by cords which are attached chains in an endless loop. Sprockets, on which the chains run, are mounted on ends of the rolls. To prevent the by-passing of the uncleaned air, edges of the filter curtain pass through a labyrinth seal, formed between interlocking tapered side plates which extend into the filter pockets on the air intake side, and into corresponding pockets on the clean air side.

Federal Specification

Federal Specifications board has prepared a proposed specification for bronze globe valves for land use. Copies of the specification, known as TS-2109, may be purchased from the superintendent of documents, government printing office, Washington.

Single Deck Screen Is Suspended by Cables

Allis-Chalmers Mfg. Co., Milwaukee, has introduced a new single-deck screen in sizes from 1½x3 to 5x10 feet. These screens, of the float-in-air type, are suspended by cables and springs. A rapid adjustable vibrating motion is produced by counter-weighted wheels mounted on the drive shaft and supported by anti-



The screen is suitable for handling raw foundry sand

friction bearings above the screen body or vibrating member. The screen will handle medium to fine size commercial materials in moderate tonnages. The unit is claimed to be especially suitable for raw foundry sand. However, the double-deck screen of the same type is employed for reconditioning.

Die Casting Machine Operates Hydraulically

Lester Engineering Co., 278 Rockefeller building, Cleveland, has introduced a new fully hydraulic type die casting machine. High productive speed is obtained through a fast moving hydraulic toggle mechanism for die movement. This device is positive acting, developing a safe locking pressure of 35 tons. This power can be utilized in pulling large cores. An automatic plunger control is used in conjunction with the die operating mechanism to eliminate lost time between the various phases of the cycle of operation.

Metal is injected into the die by the solid displacement method. The injecting die device is so constructed as to function properly for the life of the vital parts, it is claimed. Wear between the plunger and metal cylinder is taken up automatically and metal pressure is maintained the same.

Operation of the machine is controlled by a single lever. Pulling the lever out will close the die hydraulically, and as soon as closed completely and locked, the plunger will operate forcing the metal into the die. The plunger will remain down, holding pressure on the metal for as long a period of time as required for the particular part being cast. An easily accessible adjustment makes possible the varying of time delay. The plunger then will return to its original position by pushing the operating lever back, and then the dies will be opened.

The die opening is 5 inches; the maximum die height, 12-inches; and the minimum die height, 4-inches. Clearance between the bars is 12x8-inches and the metal pot capacity is 300 pounds. Maximum speed is 600 operations per hour.

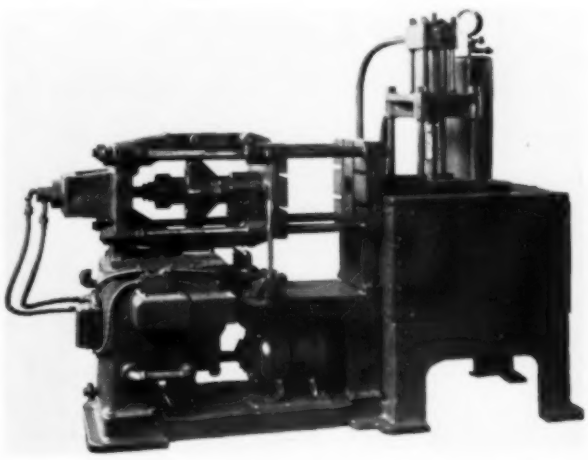
Removes Foreign Substances from Air

Alexander Milburn Co., 1416 West Baltimore street, Baltimore, recently has introduced a purifier for conditioning air or gas. The unit has a glass shell through which any accumulated oil, moisture or dirt can be seen, thus enabling the user to determine quickly when cleaning is necesary.

A series of perforated plates and strainers remove foreign substances from the air or gas lines. The device has a small number of parts and can be dissembled for cleaning quickly and easily. The purifier is equipped with a full size 3-inch diaphragm regulator having a graduated gage.

Office and laboratory of Crowell & Murry Inc. have been moved to 806 Perry-Payne building, Cleveland.

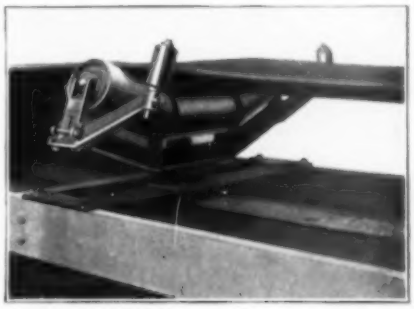
Federal Foundry Supply Co., 4600 East Seventy-first street, Cleveland, is constructing a 2-story addition, 60 square feet, at a cost of $20,000.



The hydraulic toggle mechanism develops a safe locking pressure at 35 tons

Belt Conveyor Idler Is Self Aligning

Link-Belt Co., 910 South Michigan avenue, Chicago, has introduced a self-aligning antifriction idler for troughed conveyor belts. The idler is made up of standard belt carrying rolls mounted in a supporting frame provided with arms extending parallel with, and at the sides of the belt, on which actuating rolls are mounted for



The idler is made up of standard belt carrying rolls

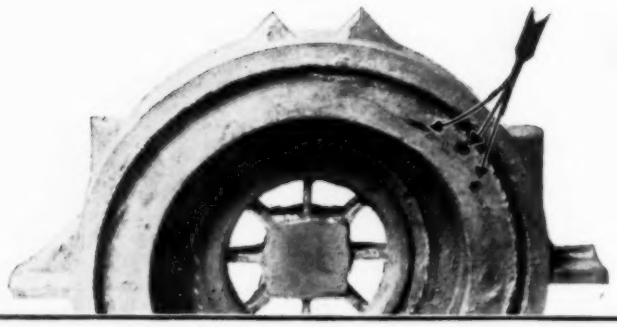
the purpose of swiveling the idler frame promptly when the crooked running belt crowds sidewise enough to engage either of them. This troughing idler frame is supported by an antifriction pivotal bearing carried on a cross member or subframe bolted to the conveyor stringers.

Self-aligning idlers are used at intervals between the stationary carrying idlers of the conveyor and their operation is said to be unaffected either by the speed of the conveyor belt, or the load.

Lift Truck Made In Three Capacities

Lyon Iron Works, Greene, N. Y., recently has introduced a new hydraulic lift truck, which is made in three standard capacities namely, 3500 pounds, 5000 pounds, and 6000 pounds. An angle iron frame is said to add to the rigidity and strength and give wider bearing for the skid platform. Roller bearings in the front wheels take side thrust when turning, thus making steering easier and lessening wear on wheels.

The head has a new leak-proof air vent which allows turning over the truck to grease the wheels or for other purposes, without losing oil. The standard lift is 3-inches. Speed of lowering the load is controlled by pressure on the release lever.



CASTINGS LIKE THIS SHOULD BE SAVED with SMOOTH-ON NO. 4

DON'T risk complaint or sale at reduced price because of a few slight surface defects at unimportant locations. True up the depressions with fillings of Smooth-On No. 4, which hardens into metallic iron, looks like iron and *acts like iron.* Send out every casting with fully corrected surface. Your output will sell at the high price, and be worth more for the added finish.

Smooth-On No. 4 is made in three compositions, to offer a choice of color, lustre and texture for any iron or steel casting.

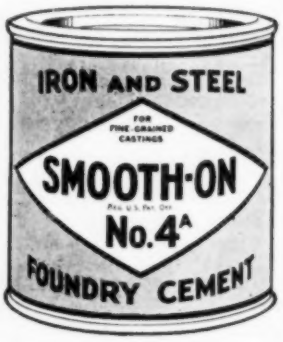
Smooth-On No. 4AA. For light gray castings and machined surfaces. Has high metallic lustre and takes a fine machine finish.

Smooth-On No. 4A. For medium gray castings. A fine-grained cement that has a good metallic lustre.

Smooth-On No. 4B. For dark gray castings. A cement of coarser grain and darker shade.

Correct selection and application produces a filling which cannot be detected.

You overlook an opportunity if you fail to utilize the benefits from Smooth-On treatment. All the Smooth-On No. 4 used in a year would probably cost less than the loss of a single good casting because of slight surface defects.



FREE
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SAMPLES

Smooth-On Nos. 4AA, 4A and 4B is packed in 1-lb. and 5-lb. can, 25-lb. pail or 100-lb. keg. Mail coupon for prices and free hardened and working samples.

Smooth-On Mfg. Co., Dept. 17,
570 Communipaw Ave., Jersey City, N. J.

Please send samples of ☐ Smooth-On No. 4AA ☐ Smooth-On No. 4A ☐ Smooth-On No. 4B

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***Do it with* SMOOTH-ON**

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DAYTON, OHIO
HERCULES

"ALL You Need To Know"

—about Portable Pneumatic Grinders for Foundries

First is HERCULES—*second* is The Buckeye Portable Tool Co.—*third* is the No. 300 Series Portable Pneumatic Grinders bearing this name and made by this Company . . . It's not all there *is* to know, but it's all you *need* to know!

Here is *more* power—*less* weight—*minimum* upkeep—*speed*—*endurance*—*low* air consumption—in a wide range of r. p. m.'s and wheel capacities to meet all foundry needs.

If want to know more, we'll gladly tell you—or we'll send engineering counsel to aid in solving your grinding problems.

The Buckeye Portable Tool Co.

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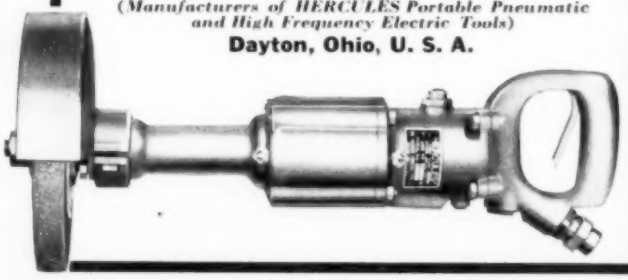

A BAG—or a Truck Load?
FOR LOWEST BLAST CLEANING COSTS
One bag of "Certified" Steel Grit, or Steel Shot, will do the work of a Truckload of Sand! . . . and do it quicker, at lower cost per ton, with less dust, than any other abrasive on the market. If you are interested in reduced cleaning costs and greater profits—use "CERTIFIED" STEEL ABRASIVES.
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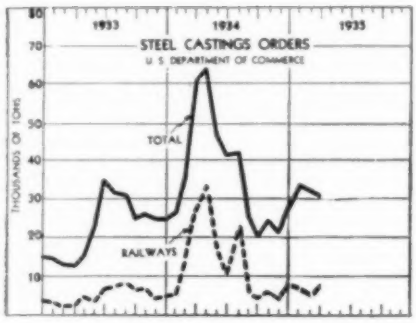
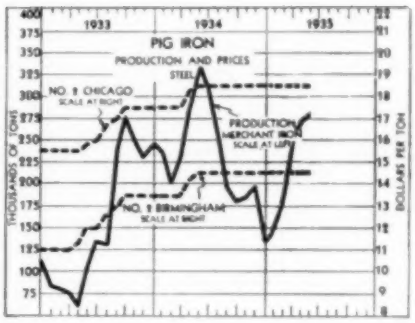
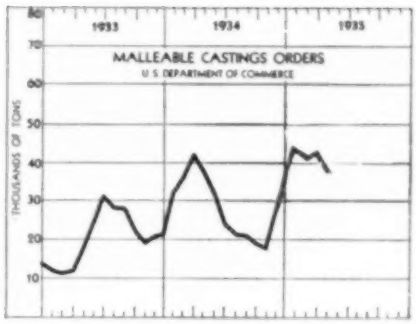






Foundry Activities

Reflect Industrial Trends

BUSINESS of the Canadian Steel Foundries, Ltd., Montreal, Que., and Pratt & Letchworth Co. Ltd., Brantford, Ont., now is being operated under the name of Canadian Car & Foundry Co. Ltd., with branch plants at Toronto, Ont., Amherst, N. S., Fort William, Ont., and Welland, Ont.

* * *

Iron City Furnace Co., St. Louis, Mo., has been incorporated by C. J. Scullin and Raymond H. Albers.

* * *

Aluminum Co of America, 3311 Dunn road, Detroit, is planning to erect a 1-story addition to its plant, 35 x 312 feet.

* * *

Independent Foundry Co., Portland, Ore., recently sustained considerable damage to its plant and equipment due to fire.

* * *

John Deere Tractor Co., Waterloo, Iowa, manufacturers of farm machinery, has awarded contract for construction of plant addition costing $50,000.

* * *

Crampton Foundries Ltd. has purchased the business formerly conducted by the Riverside Foundry Inc. 1971 Tansley street, Montreal, Que., and will produce alloy and gray iron castings. P. P. Crampton is president and managing director, and D. S. Fraser is vice president of the company.

* * *

Reorganization of the Read Machinery Co., York, Pa. was completed in April when all the assets of the old company were transferred to Read Machinery Co. Inc., and operation under federal receivership was terminated. Orders on hand are sufficient to operate the plant to capacity for some months to come, it is reported.

* * *

Brass foundry of the Blake Specialty Co., Rock Island, Ill., recently was damaged by fire.

* * *

Simplicity Pattern Co., Niles, Mich., is planning to erect a factory addition at an estimated cost of $8000.

* * *

Carondelet Foundry Co., St. Louis, has purchased a second 3000-pound rocking type electric furnace to handle an increased tonnage of iron castings.

* * *

Bearing Bronze Casting Co., Cleveland, has been incorporated by M. G. Leypoldt, E. C. Manning, C. L. Hange and R. E. Meyers, 14010 Woodworth road.

* * *

Laetz Foundry Co., 800 Woodside avenue, Bay City, Mich., has been organized to engage in general foundry business, by Mary F. Cooley, Bay City, Mich.

* * *

J. E. Gilson Co., Port Washington, Wis., gray iron founder, has let contracts for erection of an addition, 60 x 100 feet. New equipment includes modern sand-handling machinery.

* * *

American Bearing Corp., Indianapolis, Ind., has been formed to manufacture machinery, engines, and bearings of all types by Peter Lambertus, William A. Dail and William C. Beschorman.

* * *

Pulaski Foundry & Mfg. Co., Pulaski, Va., including the main foundry, 18 smaller buildings and machinery and equipment, has been acquired by the Pulaski National bank.

* * *

Production of gray iron and steel castings declined during April in the Philadelphia district, according to reports of the Industrial Research department, University of Pennsylvania. The decline of 5.1 per cent in the output of gray iron castings was chiefly seasonal and was less than the decline in the corresponding month last year. As a result the output in April exceeded that of April, 1934, the first time this year

RAW MATERIAL PRICES
June 5, 1935

Iron	
No. 2 foundry, Valley	$18.50
No. 2 Southern, Birmingham	14.50
No. 2 foundry, Chicago	18.50
No. 2 foundry, Buffalo	18.50
Basic, Buffalo	17.50
Basic, Valley	18.00
Malleable, Chicago	18.50
Malleable, Buffalo	19.00
Charcoal iron, furnace	21.00
Coke	
Connellsville beehive premium	$5.10 to $ 5.35
Wise county beehive coke	4.30 to 5.30
Detroit by-product coke	8.50
Scrap	
Heavy melting steel, Valley	$11.50 to $12.00
Heavy melting steel, Pitts	12.25 to 12.75
Heavy melting steel, Chicago	10.00 to 10.50
Stove plate, Buffalo	9.25 to 9.75
Stove plate, Chicago	6.00 to 6.50
No. 1 cast, New York	7.00 to 7.25
No. 1 cast, mchy., Chicago	9.50 to 10.00
No. 1 cast, Pittsburgh	12.75 to 13.25
No. 1 cast, Philadelphia	11.00 to 12.00
No. 1 cast, Birmingham	9.00 to 9.50
Car wheels, iron, Pittsburgh	12.50 to 13.00
Car wheels, iron, Chicago	10.50 to 11.00
Railroad malleable, Chicago	13.50 to 14.00
Malleable, Buffalo	13.00 to 13.50
Nonferrous Metals	**Cents per pound**
Castings copper, refinery	8.00 to 8.25
Straits tin	51.20
Aluminum, 99 per cent	19.00 to 21.00
Aluminum, No. 12 (Secondary)	16.75 to 17.25
Lead, New York	4.00 to 4.10
Antimony, New York	12.75
Nickel, electro	35.00
Zinc, East St. Louis, Ill.	4.30

that production has exceeded that of the corresponding period of last year. Output of steel castings was 22.0 per cent less than in April, 1934 with shipments declining more than one-third.

* * *

Williams Bros. Inc., 1125 West Beardsley avenue, Elkhart, Ind., recently has been formed to manufacture nonferrous castings, by Ursa S. Williams, Sidney W. Williams and Terrance C. Wertz.

* * *

South Boston Iron Foundry, Inc., 1910 Old Colony avenue, South Boston, Mass., has been incorporated to carry on a general iron foundry and machine shop business with a capitalization of $10,000. Victor F. Poltorak is president and treasurer.

* * *

An iron and brass foundry for making all forms of castings is established at Dillon, S. C. The new plant, of which James F. McKay and J. D. McKay are proprietors, will be located at the east end of Cleveland street, Dillon.

* * *

H. Brewer & Co., Tecumseh, Mich., has been reorganized and has had plans approved by the Michigan securities commission, validating an issue of common stock soon to be offered. E. M. Campbell has been elected president of the new company.

* * *

Stanford Brass Mfg. Co., Imlay City, Mich., again is in operation after an being idle for about two years. The company expects to employ from 40 to 50 men as soon as conditions will warrant. At the present time, the plant is making parts for several automobile companies and also has large orders ahead for plumbing supplies from eastern distributors.

* * *

Standard Brake Shoe & Foundry Co., Pine Bluff, Ark., will open a branch plant at Memphis, Tenn. at a cost of $200,000. Annual payroll will be approximately $300,000, and the products will include carbon and alloy steel castings, gray iron and alloy iron castings and brake shoes for railways and traction lines. The Standard Co. recently purchased the site of the old oak flooring plant of the Chicago Mill & Lumber Co., located just outside the city limits of Memphis, and comprising 11½ acres. Erection of the first unit will start in a short time and other units will follow. General offices of the Standard Brake Shoe & Foundry Co. are at Pine Bluff, Ark., with branches at St. Louis, Chicago, Cleveland, New York, Washington, Norfolk, Denver, San Francisco, Tulsa, New Orleans and Memphis. The Memphis office is at 422 Exchange building. E. S. Dilley is head of the company.

* * *

Frank V. Burrows, receiver, for Muskegon Brass Foundry Co., Muskegon, Mich., formerly Enterprise Brass Works, 21 West Broadway, Muskegon Heights, Mich., has been ordered by the court to proceed with liquidation of the company's affairs. Time for filing claims expires Aug. 3, 1935.

* * *

Index of foundry equipment orders for April, according to a report of the Foundry Equipment Manufacturers' association, Cleveland, was 113.0 as compared with 68.0 in March and 67.8 in April, 1934. Index of shipments was 69.7 compared with 82.6 in March and 55.5 in April, a year ago.

* * *

Blackburn Foundry Co., St. Bernard, O., recently completed a 35-ton planer table, said by officials of the company to be one of the largest castings ever made in Cincinnati, for the Cincinnati Planer Co., Oakley. More than 80,000 pounds of molten metal were poured into the mold, the planer being 36 feet long and 5 feet wide.

* * *

United States Pipe & Foundry Co., Chattanooga, Tenn., plans a $250,000 expansion and improvement program, according to J. T. Giles, resident manager. The Whiteside street fittings plant is to be removed to the Twenty-seventh street plant and a new fittings plant erected. New equipment will be installed in both plants. A new machine shop and pattern shop, each 175 feet long are to be erected and other shops remodeled.

New Trade Publications

SCRAP—Globe Iron Co., Jackson, O., has distributed a bulletin on "The Effective Use of Cast Iron Scrap in the Cupola Charge," which contains the results of an investigation of the Ohio State university, college of engineering, in co-operation with the Globe Iron Co. The work was prepared by A. H. Dierker and R. P. Schneider.

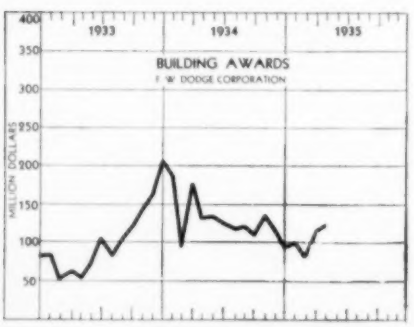
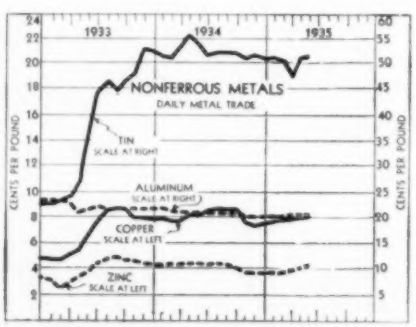
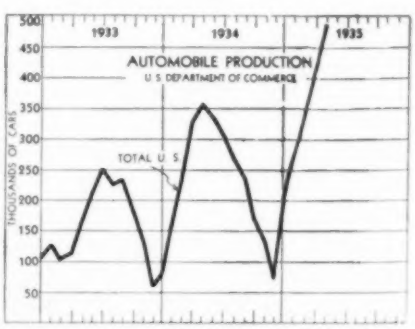
ELECTRODES — Metal & Thermit Corp., 120 Broadway, New York, has published a booklet on its line of heavy mineral coated electrodes. Various advantages claimed for that type of electrode are presented in detail.

PRESERVATION — Tennessee Eastman Corp., Kingsport, Tenn., has published a booklet dealing with protection of wood against decay, dry rot and boring insects. Definite recommendations for different types of construction are presented.

TUMBLING MILLS—A bulletin on its counterbalanced roller bearing tumbling mills, in which general specifications of the unit are listed, has been published by the Whiting Corp., Harvey, Ill. That company also has prepared a bulletin on its turntables for shops and yards.

SAND TESTING—Harry W. Dietert Co., 676 West Grand boulevard, Detroit, has published its catalog No. 103 devoted to its line of foundry sand testing and control equipment. Several new units recently developed by that company are included in the catalog.

COMPRESSORS—Worthington Pump & Machinery Corp., Harrison, N. J., recently has published an illustrated folder dealing with its line of vertical angle air compressors. Detailed information is presented on design and construction.

ROLLER CONVEYORS — A folder showing roller conveyor details recently has been published by the Logan Co., Louisville, Ky. Features such as the hexagon shaft, dust protected bearings and pressure lubricated bearings are stressed.

CUPOLA CONTROL—Edwin S. Carman Inc., Lee road at Mayfield, Cleveland, has published a booklet on a cupola control system which utilizes a control gage indicating the amount of blast required for complete combustion in the melting zone from temperatures of 20 degrees below zero to 100 degrees above, with changing barometer over the entire range.